Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

INDEX FOR VOLUME XV, 1902.

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A Practical Journal of Railway Motive Power and Rolling Stock

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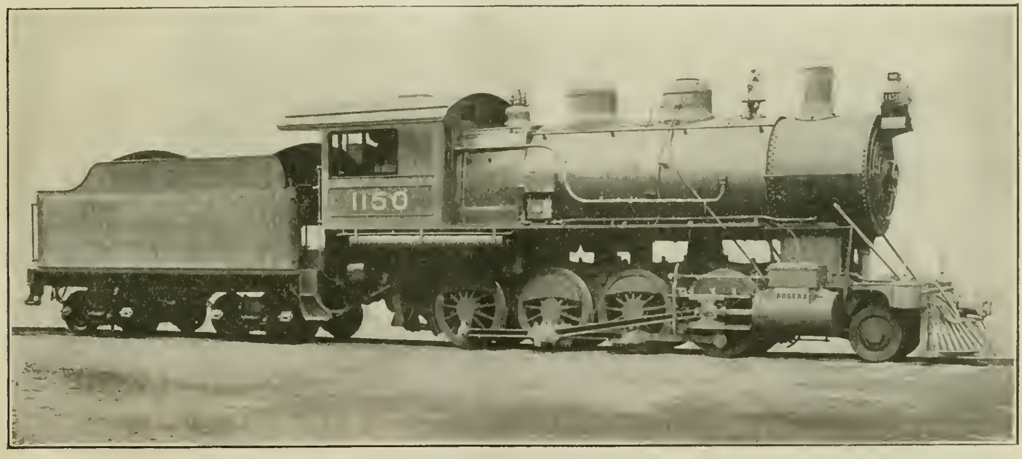
Rogers Consolidation for Great Northern Railway.

The consolidation locomotive hereby shown is an exceptionally heavy and powerful engine recently built by the Rogers Locomotive Works for the Great Northern Railway Company. The weight of the engine in working order is 195,000 pounds, of which 180,000 pounds are on the driving wheels. The engine has driving-wheel base of 16 feet and a total wheel base of 24 feet 3 inches. The weight is very well distributed on the driving wheels and the rigid wheel base provides an engine that will work very freely on curved track.

The cylinders are 20 x 32 inches and the driving wheels are 55 inches diameter. The boiler carries a working pressure of 210 pounds to the square inch. From these figures we find that the tractive power of the engine is 41,541 pounds and the ratio of adhesion to tractive power is 4.3.

The boiler is of the Belpaire type, 74 inches diameter at the smokebox and provides 2,744 square feet of heating surface of which 2,539 square feet are in the tubes and 205 square feet in the firebox. The grate area is 59 square feet, which is very liberal for a Belpaire firebox. The driving axles are steel with journals 9 x 12 inches. The truck wheels are 33 inches diameter with Krupp steel tires. The axles of the truck have journals 6 x 12 inches. The engine is very well provided with all the necessary conveniences for operation and for the comfort of enginemen.



ROGERS CONSOLIDATION FOR GREAT NORTHERN.

Saving Oil and Wasting Coal.

The unceasing zeal with which some railroad officials pursue the subject of saving lubricants has become a matter of ridicule in many quarters. Those who are constantly talking about oil saving and demanding that railway machinery should be operated with the least possible expenditure of lubricants nearly always forget that they are pursuing the policy of saving the cent and wasting the dollar. The additional expense of coal and repairs often wastes a hundred times more than the saving in oil amounts to. On this question the views of Mr. Walsh, one of the Galena Oil Company's experts, is worthy of consideration. At a meeting of the Southern & Southwestern Railway Club, he said:

"The disposition of the railroad companies dealing with the oil companies is to continually make the oil companies reduce their prices, with the proviso on the part of the railroads that they will leave a full margin of profits for the oil companies. There is a point below where you cannot reduce lubrication without interfering with the profits on coal consumption and train speed, and the sooner the railroads understand that the better it will be for the economical administration of their affairs. It has been proven that when lubrication is slighted, while you may run with almost no trouble from hot boxes, the friction is so great that with the dynamometer car it will show up outrageously, with bad results to the railroad companies. With other cars that is not true, because it will result very quickly in a change that is not seen with freight trains. With slow trains the speed is so slow that the heat in the journals passes off, so that it does not produce hot boxes. With the application of the dynamometer car is when these things are found out. It is poor policy on the part of the railroad companies to reduce their lubrication beyond what is determined to be a safe point, and that cannot be very readily done. It is a fact that has been established without any room for question that where you reduce the quantity applied to your journals you simply double the percentage of cost of fuel. It is a matter upon which I am very glad you gave me an opportunity to express myself, and I thank you."

The Expense of Mistakes.

BY F. P. ROESCH.

FIRST PAPER.

It is no hard matter to impress upon the mind of the average railway employé the fact that every dollar he saves for the company in the performance of his respective duties is just that much upon the credit side of the company's ledger. He can readily see, if he saves a dollar for the company, that the company will be a dollar ahead, but in urging upon him to make this saving wherever he can, it is not always easy to convince him that he will indirectly share in his own savings. No. "He is from Missouri: you have to show him!"

The prosperity of each individual employé of a railroad company depends on the prosperity of the company as a whole. Every employé has opportunities to save a dollar for the company occasionally. Every attention they deserve, while their effect on the revenues may occasionally be something enormous. As I said before, each department has its own particular leaks, all contributing toward the expense of operation. In this article we wish to deal with the leaks in the mechanical department due to the mistakes of engineers in diagnosing the diseases of their engines; in other words, their mistakes in locating the various pounds and blows developed in a locomotive in active service.

The average engineer takes no little pride in his engine, especially when he has been fortunate enough to be assigned to a good one. The young runner knows that his ability to make good runs and get over the road in good shape depends largely on the condition in which he keeps his engine. He knows that the engine with the least pound is least liable to knock something off, lose a rod, or pound hot, or be subject to any of the numerous ills that ful source of expense to the company employing him.

This is one thing the young runner should be particular to guard against. In making his reports he should make sure that he is right above all things. No doubt anyone is liable to a mistake at times, and of course the more seldom his mistakes occur the more readily are they over looked; but if his mistakes are the rule instead of the exception they will soon begin to reflect back on him personally, and he will be in hot water all the time.

It does not take a roundhouse man long to size up the engineer who is continually making the wrong report. They get so they pay no attention whatever to anything he says, quit trying to do his work, but wait until he lays off and another man takes his engine out in whom they have confidence enough to believe he knows what he is talking about when reporting work on an engine.

BALDWIN'S METHOD OF WEIGHING LOCOMOTIVES. NO GUESSING HOW MUCH WEIGHT IS ON EACH PAIR OF WHEELS.

department has its leaks. The stoppage of these leaks is sometimes all that is necessary to put a road on a paying basis. A prosperous railroad can afford better pay, better facilities, better power, and better track than the one whose revenues barely meet the expenses. No argument is necessary to convince any engineer or fireman that he can make more money and make it easier on a first-class engine running over good track than he can on a scrap heap running over two streaks of rust. The money all can save to the company will go far toward obtaining this better power, track, etc., and in that way it is plain that all will be benefited thereby.

The little leaks incidental to the operation of a railroad—just because they are little and not so forcibly brought to the attention of the higher officials—are sometimes passed by without receiving the the traveling scrap heap is liable to in making a close or fast run, so he tries to keep his engine in the best possible condition, reporting every little defect he can find; every little click, every blow. So far, so good; but let him beware lest he fall into the reporting habit, and begin to feel that his trip is not complete unless he files at least half a page on the roundhouse work book on his arrival. Understand no fault is found with any engineer for giving his engine a good thorough inspection on arrival and reporting every defect, but when through habit or carelessness he imagines himself to correctly locate really existing faults—as, for instance, if a pound develops, instead of locating it, reporting everything that moves on that side, "examined, reduced, lined up," etc.—it is then that he becomes a trial to the roundhouse foreman, a worry to himself, and a fruit-

Thus the careless or incompetent man will soon find his engine a veritable scrap heap in spite of all his reporting. Therefore, be careful. Mistakes cost money. The roundhouse man needs no proof of this, but I will try to prove it to our friends the engineers, and with this preamble will talk to the engineers and firemen direct. Let us see what we can do toward stopping some leaks.

Denver, Colo.

Heavy Locomotives in 1833 and at Present.

In these days of heavy locomotives and the evident hesitation of our English cousins to adopt them, it is strange to read the following from Robert Stephenson to Robert L. Stevens in 1833:

"I am sorry the feeling in the United States in favor of light railways is so gen-

eral. In England we are making each succeeding railway stronger and more substantial. Small engines are losing ground and large ones are daily demonstrating that powerful engines are the most economical."

Brother Jonathan learned the lesson, but John Bull seems to have forgotten this good advice.

Railroading in a Reservoir.

SOME OF THE INTERESTING FEATURES OF BOSTON'S NEW WATER SUPPLY.

BY FRED H. COLVIN.

Long & Little also have a narrow gage in the reservoir for the removal of earth, and their track is in very good shape, all things considered. They have 65,320 feet of track, sidings included, and only four locomotives, two of 1^ and two of 15 tons. They have, however, a hoist or inclined plane, shown, with a 50 horsepower hoisting engine. This incline is a 10-per-cent. grade, but saves a long haul around to get the earth up to the top of the dike, where it is needed.

Another method of loading cars is shown by one of Nawn & Brock's dumping platforms. This is merely a rough platform at the foot of a side hill, and contains pockets as shown. These hold several cartloads each, so that carts can dump and go away instead of waiting, if a train is not at the loading stage. The cars run under the stage and are loaded very quickly, then hauled away by the locomotive to dump on the dike, perhaps several miles away.

The stripping itself has to be done by hand, and the view of the strippers shows the men at work filling the carts, which are then hauled away to the loading stage. This particular part of the reservoir formerly bore the name of "Big Kettle Hole." The waterline is shown by the height of the stripping. The stumps are pulled out, piled together and burned as thoroughly as possible.

Still another contracting firm for this work of soil stripping is Moulton & O'Mahony, although they are sub-contractors to Nawn & Brock. Moulton & O'Mahony, however, have a total of 16,800 feet of track, five locomotives and seventy-two cars. The locomotives are 10 and 12 tons, and cars of 2½ cubic yards capacity. Some of their track is pretty ragged, but it holds the cars, and that is the main thing, I suppose.

In one of their abandoned headquarters we ran across two of their old locomotives, which were curiosities to any railroad man. Here again the film "went back" on me, and I am indebted to one of my friends for the illustrations of these antiquities. They are both built up from hoisting engine outfits, as will be seen from examination. The cabs are not artistic, but in keeping with the rest of the outfit. The one with the barrel water tank was driven by a heavy chain and sprocket. The other is more of a locomotive having tank on top, and has geared connections. One of these bore the name of Daniel Webster, I am told, but there was no evidence of this on either engine.

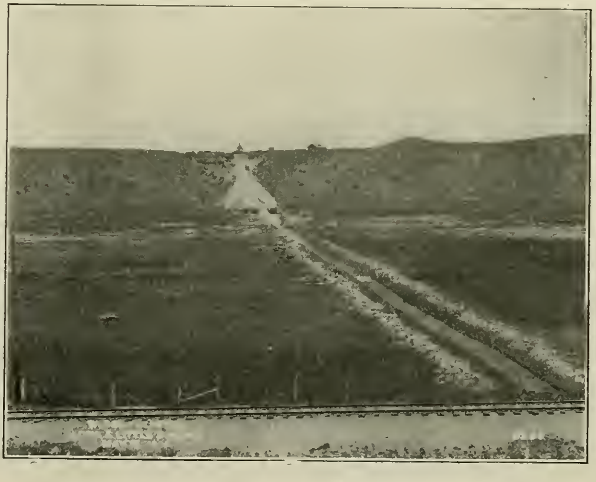
The soil that is stripped off the surface is used in filling in the dikes and in making embankments. The little engines haul their loads around curves, up grades and over trestles until the dumping ground is reached, and every precaution is taken to have the filling as solid as possible. Behind the dike in one place they have filled in for half a mile, so that it seems impossible that there should ever be a leak or a break.

The engineers for this work are among the best that could be obtained, Mr. Thos. F. Richardson and Mr. Hiram A. Miller being in charge, and they have very comfortable offices, as shown. The view shows the decoration for June 17th (Bunker Hill day), 1900, which is carefully kept in Massachusetts.

The present supply to the reservoir now under construction is estimated to be sufficient for several years, when the Ware River can be turned into it, and eventually the Swift, Westfield and Deerfield can be added, which will give a supply for a century to come. Nature has favored them in this, and their engineers were bright enough to take advantage of the combination offered.

The cost of the soil stripping is estimated at $3,000,000; the relocating of roads and rebuilding them, $250,000, and the dikes, $656,000. This does not include

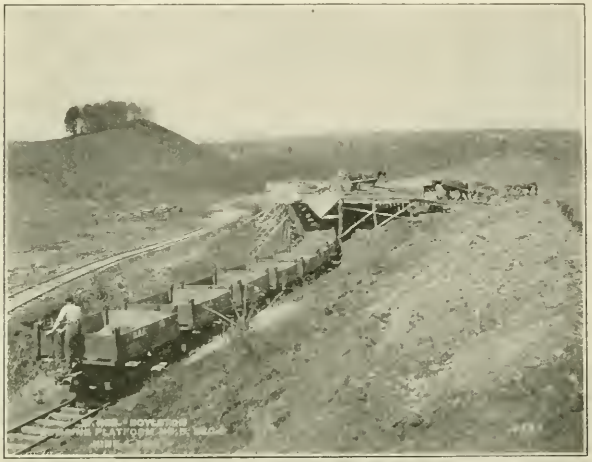
SHOWING THE WATER LINE BY THE HEIGHT STRIPPED.



ONE OF THE INCLINE RAILWAYS—BOSTON & MAINE RAILROAD IN FOREGROUND.

the moving of the tracks of the Massachusetts Central Railroad (operated by the Boston & Maine), which, as it includes a number of miles, will amount to considerable.

The reservoir will supply, as at present being built, an average of 111,000,000 gal-



LOADING AND DUMPING PLATFORM.

STANDARD GAGE RAILWAY CROSSING HIGHWAY BETWEEN QUARRY AND DAM—PART OF M'ARTHUR BROS.' PLANT.

lons of water per day of twenty-four hours, and the acqueduct has a capacity of 300,000,000 gallons, so as to provide for the future additions mentioned. The ground already stripped and to be stripped comprises 4,200 acres. Dwellings to the number of 224 will have to be removed, and four churches and six school houses must meet a similar fate. Not only will the reservoir itself be cleared of buildings, but none will be allowed to remain from which impurities can drain into the reservoir. Oakdale, the junction of the Massachusetts Central and Boston & Maine Railroads, will be practically wiped out. Sawyers Mills has also been abandoned and its buildings torn down, so that the scope of the undertaking is indeed a broad one.

Coming to the dam itself, there is little to show as yet, but it is in the hands of McArthur Brothers and Winston & Locker, of Chicago, well known in connection with the drainage canal. McArthur Brothers have installed a standard gage railroad, one of the trestles being shown. This is over a roadway leading to a quarry, also on the reservoir purchase. This can be seen to the left of the power-house shown.

This power-house contains a modern 1,000 horse-power air-compressing plant, installed by the Rand Drill Company and supplies air for the quarry as well as the work on the dam, a couple of miles away. Large wrought-iron pipes carry the air, and all the hoists, drills, etc., are operated by it.

Taken as a whole, it is probably the largest piece of work ever undertaken by

AN IMPROVISED LOCOMOTIVE.

ONE OF THE CURIOSITIES.

a municipality, and it does what is so seldom seen in such cases—anticipates the needs of the city, instead of waiting until forced to do something. It is an example which other cities can well follow, and there are several which have no time to lose in the matter either.

I am indebted to several of the engineering staff for assistance and information, and particularly to Mr. Hiram A. Miller, department engineer, and his assistant, Mr. Joseph Young, whom he detailed to accompany me. Acknowledgment is also due to my friend, John S. Allen, also a civil engineer and architect, of Clinton.

European Raiway Jottings.

BY CHARLES ROUS-MARTEN.

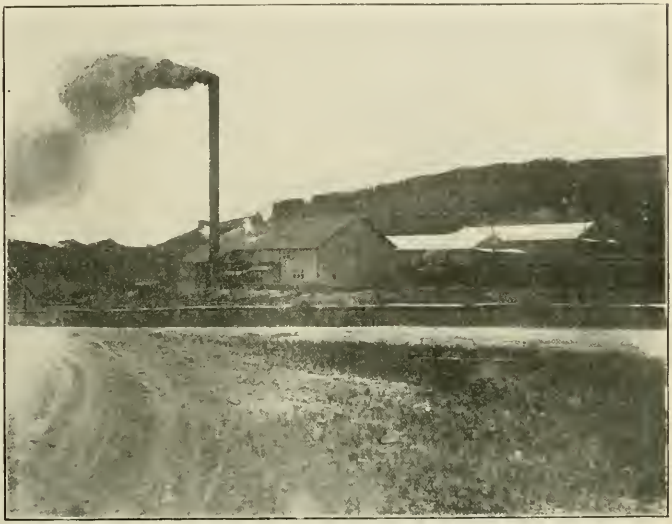
When the author of one of the papers in the engineering section of the recent meetings of the British Association declared emphatically "The single-driving wheel is as dead as the dodo," he evidently forgot that sage American saying, "Never prophesy unless you know."

For it did not take a month to see *that* implied prediction that no more single-wheelers would be built absolutely falsified. I have not come across any live dodos this year among the flocks of uninvited birds that annually visit the London parks at this season, nor have I any reason to doubt that the reports of the dodos' death are absolutely correct, and not, as Mark Twain said of a similar report about himself, "somewhat exaggerated." But I *have* met quite a number of very fine single-driver locomotives brand new and only just turned out of the shops of Doncaster, Derby and Gorton for the Great Northern, Midland and Great Central Railways respectively.

Now, it may be urged with perfect truth in the case of the Midland and Great Central lines that their newest single-wheelers are merely completions of orders given and begun last year by Mr. S. W. Johnson and Mr. H. Pollitt, and that the successor of the latter gentleman, Mr. J. G. Robinson, does not intend to build any more singles—as indeed I myself have mentioned in these columns before now—but is constructing coupled express engines of a new type. This explanation, however, would not apply to the case of the Great Northern Railway, for which line Mr. H. A. Ivatt has just turned out a batch of ten very handsome and efficient new single-driver engines. All of these have been put in hand during the current year—and century—and represent the deliberate conclusion of their designer that the type is one which he cannot profitably dispense with and which it has proved advisable to maintain and perpetuate. This decision was not arrived at by Mr. Ivatt either hastily or without due consideration and careful experiment. Two years ago he built a trial engine, (No. 266), with 91-inch single-drivers, inside cylinders 18 x 26 inches, a much larger boiler than had hitherto been employed on the Great Northern, 1,250 square feet of heating surface, 175 pounds steam pressure and a leading bogie, this last appliance being hitherto unseen on Great Northern rails in the case of inside cylinder express engines, save only in one sporadic instance of an experimental engine built by Mr. Archibald Sturrock in 1853, but not perpetuated. His successor, the late Mr. Patrick Stirling, Mr. Ivatt's predecessor, disliked the bogie for express locomotives and never used it with his inside cylinder tender-engines, only adopting it in the case of his outside cylinder 8-foot wheeled type, just as he did the outside cylinders themselves, as an unpalatable constructive necessity.

Mr. Ivatt modestly disclaimed any credit on the score of attempting novelty and declared that No. 266 was virtually Mr. Stirling's latest inside-cylinder single-wheeler supplied with a leading bogie and larger boiler. Those modifications, however, were of sufficient importance to constitute a virtually new type on the Great Northern, and the work performed was also of novel type when the capacity exhibited by No. 266 in the way of combined speed and weight-pulling was considered. So Mr. Ivatt built last year a second locomotive of practically the same design, but with cylinders 1 inch larger (*i. e.*, 19 inches) and with different valve gear. This newer engine, which bore the next consecutive number, 267, has been tried for more than a year with No. 266, the result being, as Mr. Ivatt informs me, that he could not detect any superiority of either over the other in point of efficiency, notwithstanding that one has 19-inch cylinders and the other 18-inch. Both performed in a highly satisfactory manner.

Evidently, however, Mr. Ivatt ultimately came to the concluson that the larger cylinder was preferable, the boiler proving well able to keep it supplied with steam, for the ten new engines of the same class which



1,000 H.-P. RAND AIR-COMPRESSOR PLANT—FOR QUARRY AND DAM WORK ON WACHUSETT RESERVOIR.

ENGINEERS' OFFICE, DECORATED FOR BUNKER HILL DAY.

have just been put to work all have 19-inch cylinders. It is noteworthy that this method differs entirely from that pursued by Mr. Ivatt with his newest coupled express engines of both classes, viz., the "1321" set, which have cylinders only 17½ x 26 inches, and the "990" (or Atlantic) type, whose cylinders are 18¾ x 24 inches, the coupled wheels in each being 78 inches in diameter, while the driving wheels of the "single" class are 7 feet 7 inches. On the other hand, the boilers of the "990" class, which have to supply 18¾-inch cylinders, are much larger and have 1,440 square feet of heating surface, as against 1,250 square feet in the case of the "1321" coupled, which have cylinders only 17½ inches in diameter, and of the new single-wheelers, the diameter of whose cylinders is 19 inches.

A comparison of the working of these three interesting new types of express locomotives over a lengthened period should be extremely instructive and valuable. Meanwhile, I may say in general terms that all three classes have proved to possess abundant steam, and to do their work excellently, the engines of the two coupled classes being able in fact to keep time easily with train loads of 300 British tons behind the tender at the best booked speeds, while the new single-wheelers, although I have not yet seen them tried on trains of such weight as that, nevertheless run with relative ease 250-ton trains at average speeds of 55 miles an hour, and maintain 45 to 50 miles an hour up rising grades of 0.5 per cent. with that load.

It is noteworthy that this latest thing in locomotive designing amounts to an emphatic perpetuation of two features which in combination are absolutely peculiar to Britain, viz., single-driving wheels and inside cylinders. While the former plan has not for many years been used even experimentally—except, I believe, in the case of that "385" type built for the Philadelphia & Reading Railway, of America, in 1895—the latter has not hitherto been seen at all on the American Continent, and, except on two railways in France (Northern and Western), and in Holland and Belgium, has not been employed on the European Continent, save only under the compulsion of constructive necessity as in the case of the de Glehn four-cylinder compounds, just as in Britain outside cylinders are only used at the present day under like conditions of unavoidableness, as in Mr. D. Drummond's four-cylinder non-compounds on the London & South Western, Mr. Ivatt's "Atlantic" type on the Great Northern, Mr. F. W. Webb's London & North Western compounds, the "ten-wheelers" of Messrs. Worsdell (North British) and P. Drummond (Highland) and the eight-coupled mineral engines of the former.

Mr. Ivatt, like all other leading British locomotive engineers, prefers the inside position for his cylinders. But he also believes in the single-driver, and here, in this present year, he stands virtually alone. I have no reason to assert or imply that Mr. S. W. Johnson has finally ceased to build single-wheelers for the Midland any more than Mr. Ivatt has reason to build coupled express engines for the Great Northern. But Mr. Johnson's latest Midland engines are coupled like those of all other British designers save one, while the solitarity of Mr. Ivatt in the opposite respect makes his position all the more remarkable. Practically he holds the single-driver type to be still a very valuable one when kept to duty that suits it. The Great Northern has generally easy gradients on its main line and with the exception of its expresses to and from Scotland, also perhaps Leeds, its trains are not usually of excessive weight. Many are heavy—that is to say, weigh 200 to 250 British tons, exclusive of engine and tender. With such loads Mr. Ivatt's new single-wheelers give an excellent account of themselves, even at the fast schedules prevalent on that road, viz., 50 to 55 miles an hour, start-to-stop. Apart from these twelve of the newest type, the Great Northern still employs in some of its best work no fewer than 88 single-wheelers, 52 of 8 feet 1 inch, 24 of 7 feet 7 inches, 12 of 7 feet 1 inch, built by Mr. P. Stirling before Mr. Ivatt's advent, and in several instances rebuilt by him. But on the heaviest trains of all—those weighing 250 to 330 tons—the new coupled engines built by Mr. Ivatt, both of the "Atlantic" and the eight-wheeled types, are preferably used.

For the Great Western Mr. Dean is still multiplying his 6-foot 8-inch coupled "Atbara" type with the large domeless boilers and big Belpaire fireboxes. Five more of Mr. D. Drummond's four-cylinder non-compound express engines are now at work on the London & South Western, also some more of his "Caledonian" type, and a new spark-arrester of his is being tried in some of the latter. As yet I have not been able to test the value of this appliance, but a friend who made two-foot plate journeys with a new locomotive so fitted, reports to me that the arrest of sparks appeared to be at the expense of seriously impeding the steam-generation, as the pressure could not be got above 160 pounds and the engine lost 8 minutes in the running without any checks and with a load of less than 150 tons. This is what I should have feared would be the effect of the apparatus as it had been described to me.

Many more of Mr. Billinton's "Sirdar" class with 6-foot 9-inch coupled wheels and cylinders 19 x 26 inches have been supplied to the London, Brighton & South Coast, and Mr. H. S. Wainwright is building at Ashford several more of his 6-foot 8-inch coupled "730" type for the South Eastern & Chatham. Mr. Holden continues to multiply his 7-foot coupled "Claud Hamiltons" on the Great Eastern, as does Mr. Webb his enlarged four-cylinder compounds, known as the "Alfred the Great" class, on the London & North Western. The latest novelties, however, are the new express and freight types just introduced by Mr. J. G. Robinson on the Great Central Railway. The former have cylinders 19½ x 26 inches, coupled wheels 6 feet 9 inches, and large boilers 4 feet 9 inches in diameter. The freight engines have still larger boilers 5 feet in diameter, 5-foot wheels, six coupled, and cylinders 18½ x 26 inches. Both classes have Belpaire fireboxes.

The French Northern Railway has ordered a further batch of the "Atlantic" type of de Glehn compound express engines. They will resemble the 1900 Exhibition engine No. 2642, but will be somewhat longer, and their tenders will run on six wheels instead of eight. M. du Bousquet has put to work on the same railway forty more ten-wheeler de Glehn compounds of the 3.121 to 3.170 class, taking on the numbering to 3.120. They have six coupled 5-foot 8-inch wheels and leading bogies. Planned originally for fast goods service they have come more and more into use on heavy passenger expresses which they work with admirable efficiency. Many similar engines, all being four-cylinder compounds on the de Glehn system, are now at work on the Eastern, Western, Southern and P. L. M. railways of France, also in Switzerland and Germany.

According to my latest advices from the P. L. M. Railway, the newest Baldwin express engines had not yet got into regular duty, so no comparison between them and the de Glehn compounds is at present possible.

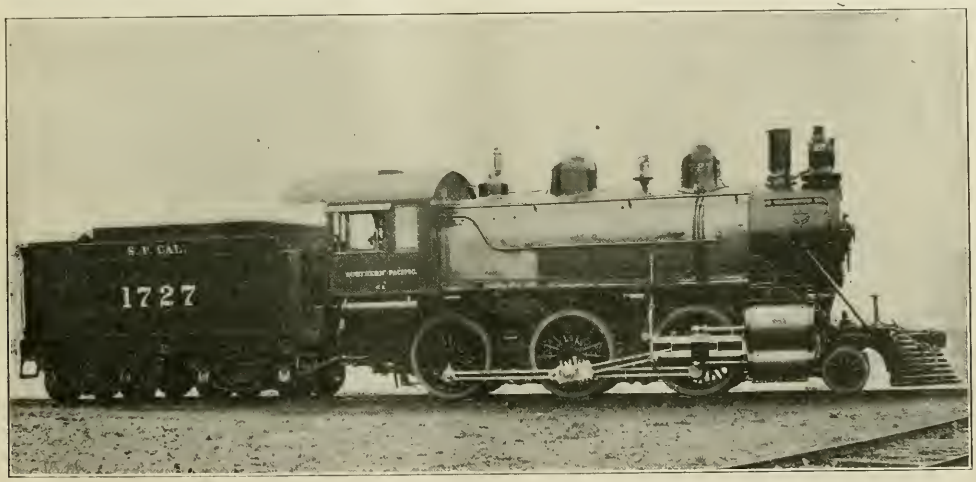
France still leads the whole world in respect of fastest long-distance runs. The winter time-tables just out show one from Paris to Calais—185½ miles—in 3 hours 15 minutes, averaging 57.1 miles an hour, including a stop of 4 minutes; also Orleans (Les Aubrais Station) to Bordeaux (St. Jean Station)—289½ miles—in 5 hours 18 minutes, inclusive, averaging 54.6 miles an hour, including three intermediate stops of 5 minutes each. In individual runs France is second only to America, having start-to-stop lengths at 60.5, 58.2, 57.3, 57.1 and 57.0 miles an hour. Scotland has one at 59.1 and England has one at 58.9, but no other so fast as 56 from start to stop. In this respect America is of course "first and the rest nowhere."

The Vislanda-Bolmen Railroad, Sweden, have been making an experiment with pressed and dried peat as fuel with a train consisting of locomotive, fifteen loaded freight cars and one passenger car. The distance was about 22 miles, and the time-table was set for lower speed than the ordinary, but this train arrived in due time at the respective stations, and at the final station fifteen minutes ahead of time.

It looks odd to see a freight train with automatic couplers on every car and a link and pin on the locomotive tender. The link looks mighty weak when fastened to an M. C. B. couper.

Southern Pacific Vauclain Mogul.

We illustrate on this and the next page a half-tone illustration and line cuts of a very powerful compound Mogul engine recently built by the Baldwin Locomotive Works for the Southern Pacific Company. The engine has cylinders 15½ and 26 x 28 inches. The driving wheels are 63 inches outside diameter and the boiler carries a working pressure of 200 pounds to the square inch, providing with other dimensions a tractive power of 29,255 pounds and a ratio of adhesion of about 5. There are 310 two-inch tubes 13 feet long. The firebox is 108 inches long, 66 inches wide, 67 inches deep at the front and 58 inches deep at the back. There are 2,256.8 square feet of heating surface, of which 2,096.5 are in the tubes and the remainder in the firebox. The rigid wheel base is 15 feet 2 inches, the total engine wheel base 23 feet 8 inches. The weight on the driving wheels is 144,120 pounds and 22,200 pounds on the pony truck. The driving-wheel journals are 9 x 12 inches and all the other journals are liberal in proportion. The line cuts show a great many of the details of construction which we need not describe.



BALDWIN COMPOUND MOGUL FOR SOUTHERN PACIFIC.

A newspaper item is going the rounds which says that Edward Entwistle, the man who seventy years ago took George Stephenson's engine "Rocket," which took the government prizes on its trial trip between Liverpool and Manchester, England, is still alive, living in Des Moines, Iowa. We are rather skeptical about the truth of this statement because we have heard of about a dozen men in America who claimed to have run the "Rocket" when it won the prize, not from the government—as the yarn goes—but from the Liverpool & Manchester Railway Company. History tells that George Stephenson himself ran the engine on the trial trips. The "Rocket" won the prize of 500 pounds in a competition held on October 14th, 1829, over seventy-two years ago. A man who could be entrusted to run a locomotive at that time would be well up in years to-day.

Steel Ties a Success.

Experiments made with steel ties on the Bessemer & Lake Erie road for a half-mile over one of the short curves above Greenville are reported by officials of the company to be entirely satisfactory after a year's use. These ties are made of steel plates, ½ inch thick and the width of wooden ties, bent in a semi-oval shape. A recent report of the foreman having that section of road in charge, to E. H. Utley, manager, says that the ties are as good as new and give entire satisfaction. Should the plan become generally adopted on account of the scarcity of timber, it would require many more steel mills to supply the demand, as steel ties require more steel than the rails. The forests have been almost stripped of timber suitable for ties, and for years the railroads have been looking for a substitute for the hard woods.—*Pittsburgh Post.*

Prince Works in a Locomotive Shop.

Prince Yoshio Yarmanoto, the young Japanese who is taking an apprentice's course of instruction in the Pennsylvania Railroad shops at Altoona, is said to be modest, intelligent and a keen observer. He is at present working in No. 1 erecting shop, where many engines are repaired. It was his wish to start in this department. He says: "The building of new locomotives is not difficult for me, but I wanted to get an idea of how the repairs are made. I wanted to learn what parts wear out first and how it is best to prevent them from wearing out, with a view to improving the original piece." Prince Yoshio has been in this country about two months. He will remain here three years or more studying the practical side of American railroading. Upon his return to his native country he will take a place in the Japanese Imperial Railway service.

This prince appears to have sound ideas about how to learn things. A great many industrial princes have acquired at Altoona the mental and professional motive power that is propelling them forward as kings of engineering. As a graduate, Prince Yoshio will be in good company.

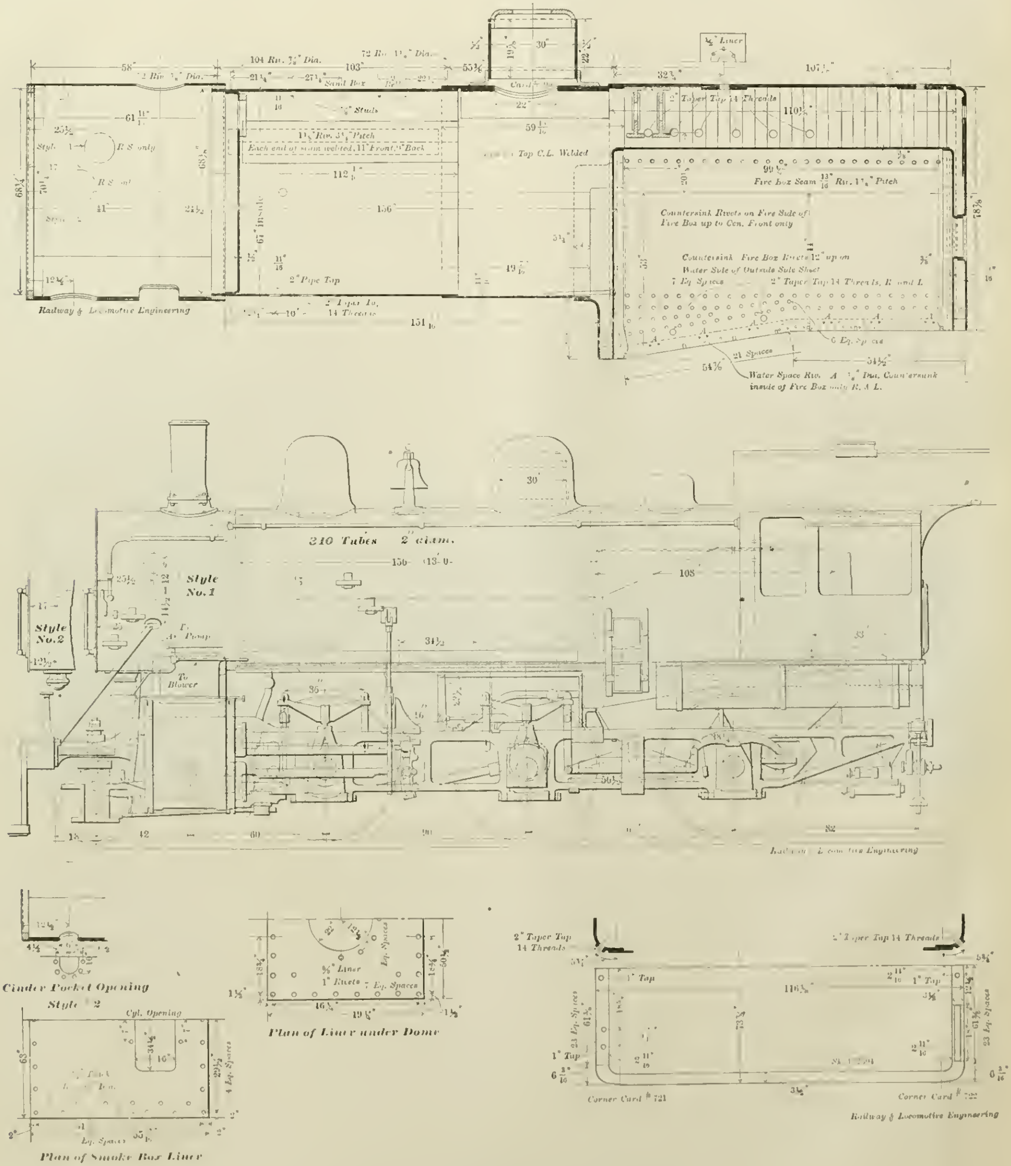
The Munising Railway, of Munising, Mich., have purchased of F. M. Hicks, of the Hicks Locomotive and Car Works, Chicago, two three-compartment combination cars. Interior finish of the first and second passenger compartment to be oak, rubbed down in oil, and compartments to have toilet rooms. Baggage compartment is to be 17 feet long, and to have letter boxes and fixtures complete. Car is to be furnished outside in Tuscan red.

Professor H. Wade Hibbard, of Sibley College, Cornell University, has been for a long time an admirer of the valuable information to be obtained from the technical press. He has been in the habit of using the technical press for the use of students and now he has made a systematic effort to have the students make better use of the technical press by forming good indexes of the articles in which they have been interested. He has lately published a pamphlet on "Engineering Periodicals and the Card Index," which reproduces an address before the students of the Society of Mechanical Engineers, Sibley College of Mechanical Engineering, Cornell University. In this he expatiates on the advantages of systematic reading of the cur-

rent engineering literature. He has a somewhat elaborate arrangement for the individual card index and its application to engineering. An engineering student who wishes to secure a systematic record of articles likely to be useful to him in his profession ought to study Professor Hibbard's address very carefully and profit by the advice given. We believe the pamphlet can be obtained by application to Professor Hibbard, Sibley College, Ithaca, N. Y.

The Mason Regulator Company, of Boston, Mass., have issued a neat little pocket catalogue of their steam regulating devices and steam pumps. These include Air-Brake Pump Governors, Locomotive Reducing Valves, Reducing Valves and many other devices in this line. Those who are engaged in this line of work will be interested to have a copy for reference, as well as to show the latest improvements.

The Pintsch system of car and buoy lighting has received Gold Medals and the highest awards for excellence and efficiency at the World's Expositions at Moscow, Vienna, St. Petersburg, London, Berlin, Paris and Chicago; also at Atlanta and the Pan-American Exposition at Buffalo. This system of lighting is controlled in the United States and Canada by the Safety Car Heating & Lighting Company, 160 Broadway, New York city.



DETAILS OF VAUCLAIN COMPOUND FOR SOUTHERN PACIFIC.

General Correspondence.

Those Flat Spots on Tires.

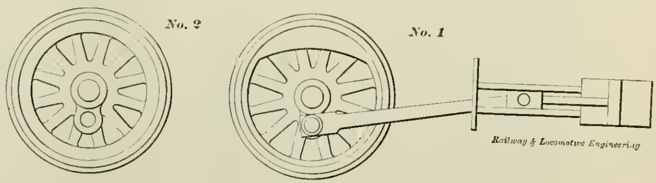
Among the mechanical men of the railways of this country in the past decade there has probably been no one subject so often and so thoroughly discussed, nor one regarding which so many theories have been advanced and so little learned of the true cause, as that of flat spots developing on driving-wheel tires, and I know of nothing in the motive-power department of our railways at the present time that is demanding more earnest research for a remedy. For several years the master mechanics have taken this matter up at their conventions and discussed it over and over again. With the practical side the traveling engineers have done likewise, and the mechanical engineers have given it their share of thought and attention for years. Some of our progressive superintendents of motive power, aided by the railway companies, have designed and built testing plants, whereby locomotives may be mounted on friction rollers and put through tests as accurate as service tests on the road, and in some respects more so. One of our leading technical universities has an ideal plant of this kind and has made several tests to find out the cause of this very serious defect, and yet with all that has been said and done the locomotives on our railways to-day continue to pound along in the same old way with flat spots in their tires. Locomotive engineers and firemen riding from three to four thousand miles a month on these deformities realize probably more forcibly than others interested, by reason of their sore sides and lame backs, the need of a remedy. Superintendents of motive power realize it by having to take engines into shops every six or eight months to turn from 100 to 300 pounds of good steel from tread of tire in order to remove these flat spots, when otherwise engines could have been kept in service six or eight months longer. They also realize the damage done to other parts of the machinery by pounding along at a speed of 30 to 60 miles per hour. The permanent way officials realize the damage these engines do to rails, bridges, etc., and the general managers realize the excessive expense of renewals of machinery, bridges, rails, and so on.

Everyone interested has been grasping for a remedy like a drowning man grasping at a straw, but as yet they have all gone under, so to speak: at least I have heard of no remedy so far. In my mind there have been many men who have advanced theories that partly cover the ground, but not wholly. I have never said anything on the subject before, at the same time have had my theory for a number of years as to the cause of this defect.

Now with your kind permission I will switch you all on to the same track as myself, and by running a block apart we will avoid collisions and arrive at the terminal safely.

We will commence and review the history of driving-wheel tires for twenty-five years past. At the beginning of this period such things as flat spots in driving-wheel tires were unknown, I believe. About twenty years ago there were occasional reports from roads in the East of locomotives getting flat tires, and you will note they commenced to increase the speed of trains down there about that time. About fifteen years ago this disease struck the roads in the middle West, and you will also note that is about the time they commenced to increase the speed of trains there, and at present the trouble is universal and chronic. Some claim it is due to too much lap and too little lead given to valve, causing excessive compression. Others say it is caused by too much counterbalance, and so on. There have been experiments made time and time again in these directions (setting valves blind or giving them more lead, giving valves inside clearance, etc.) with no perceptible difference as to flat spots. Now, allow me to ask the question, "If these were the causes, why did not the flat spots develop thirty years ago?" Now, I claim it is speed and counterbalance combined that is the cause of all this trouble, and to substantiate my claims I will refer you again to past history. Twenty-five years ago the speed of freight trains was from 12 to 20 miles an hour; of passenger trains from 20 to 30, and just as soon as the railways commenced to increase the speed of their trains these flat spots commenced to develop on the same engines that were pulling the trains before, and the greater the speed the quicker the flat spots would develop, everything else being equal; and I will ask again if this is not proof enough that speed is an important factor in the cause.

A master mechanic or mechanical engineer can design an engine having the counterweight in driving wheels equal to the reciprocating parts, and practically it will be all right standing still or revolving at 10 or 15 miles per hour; but it is an altogether different proposition when the speed is increased to 60 or 70 miles. No up-to-date mechanical engineer would think of designing a high-speed stationary engine with a counterweight opposite crank shaft and expect a smooth-running engine. He would simply put on a flywheel, and the heavier the rim the smoother the engine will run. This same principle applies to locomotive practice of to-day. In Fig. 1 you will please note a modern driving wheel with pin on lower quarter and center of counterbalance on top quarter. Now, imagine this is the right main wheel on a locomotive going at the rate of 60 miles per hour, the weight and angularity of the main rod on the downward thrust, the steam exerting its greatest power on the piston, and the counterbalance coming over at the same time. What is the result? A hammer blow and slip, to be sure. As I look at it, it cannot be otherwise. At such a high rate of speed the centrifugal force of the wheels throws the engine out of balance by having counterbalance in wheel



FLAT SPOTS ON TIRES.

opposite pin. These flat spots develop on right wheel just ahead of the pin or near the eighth. On the left side the pin would be nearly on the quarter and that pin would be following the flat spot in left wheel, which would occur on quarter back of pin. At this point on right side is where most power is developed, and left being on center the conditions are *vice versa*. Generally there is more or less lost motion between driving boxes and wedges, also rod connections, on left side, owing to the fact that engineers are not in a position to discover the conditions on left side without more trouble.

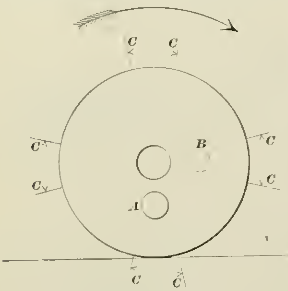
The thrust of the rod downward and counterbalance coming over at same time, with steam exerting its power on the piston, produce a hammer blow and slip on right side, but more of a slip than hammer blow on left side, owing to the loose condition of boxes, etc., which I have mentioned. These conditions may be reversed, but with a right-hand lead engine it is generally the way explained. I believe my theory is also proven by the fact that the more wheels coupled and the smaller the wheels the quicker these flat spots develop, speed and other conditions being equal; also all main tires, whether on eight, ten

or twelve-wheelers, develop flat spots first and the largest ones, and it is on these wheels of course the most weight and counterweight is of reciprocating parts. Now, my idea of a remedy is explained in Fig. 2. Take out counterbalance, or, if you please, place it in outside rim of wheel center, all that is possible—the more the better. Just follow out stationary practice as far as possible, and I believe it will save thousands of dollars to railways annually. Now, if any superintendent of motive power believes my ideas are correct and fits up an engine conforming to them, all I ask for the information is a pass and a permit to ride on the engine until I get tired of it, for I do long to ride on a smooth-running engine before I die.

I. F. WALLACE.

Minneapolis, Minn.

As there is diversity of opinions in regard to the flat spots on driving-wheel tires, so there is diversity of causes contributing to the same. My own observation while running a locomotive was, that in starting a heavy train there is a slight slip while passing the top and bottom quarters. If you have noticed an engine



FLAT SPOTS.

while getting a heavy train under way—that to the ear she sounds lame; now the engine is not lame, but there is an irregular exhaust caused by the engine slipping at different points in the revolution of the wheel. These slight slips will eventually wear a flat place on each tire.

In the enclosed sketch you will notice the right and left pins *A* and *B*, the engine being a right lead. As the wheel is passing the point shown, she will slip. Again, as the right pin passes the back center, the left pin is passing the lower quarter, where she slips again. This process is repeated as each pin is passing the quarter top or bottom, and you will find that the flat places occur at or near the points *C*, *C*, *C*, *C*, etc.

To prove my ground well taken, I would advise a visit to the wheel lathe when a set of badly worn tires are being turned; but you should be there when the first cut is taken. Now take a piece of chalk and mark the low spots on one of the wheels; then mark the spots on opposite wheel, and see how nearly opposite they are the one to the other. Of course we are losing sight of any soft spots on the tire, as it will be shown that the flat spots produced by slipping are very hard.

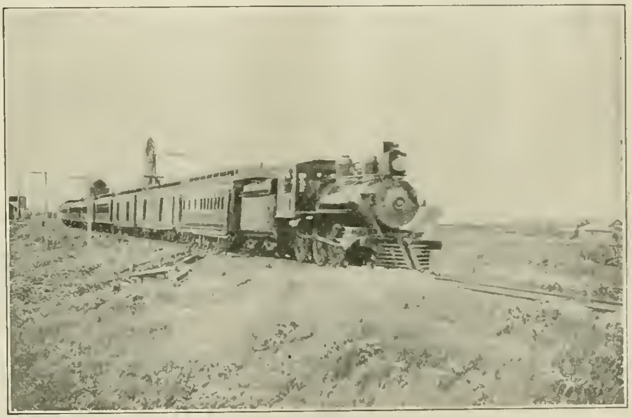
Yes, I believe that the full throttle and short cut-off aggravate the trouble; just as I know that a whole lot of the troubles that locomotives are heir to are caused by bad handling.

W. DE SANNO.

Kern City, Cal.

Covering Headlights in Sidings.

The communications concerning the use which may be made of the locomotive headlight of a train that is on a passing siding, as a means of signaling to an approaching train that it is in the "clear," that appeared in the December RAILWAY AND LOCOMOTIVE ENGINEERING, I have read carefully, with much pleasure.



BURLINGTON FLYER CAUGHT ON THE RUN.

I should infer from what Mr. J. C. Baker says in his criticism of my article on "Covering the Headlight," that he did not read it quite as carefully as he might, for it seems that he has gathered from it the idea that I recommend that the headlight be not covered on a locomotive that is standing in the clear on a passing siding. If Mr. Baker will read again what I had to say in October RAILWAY AND LOCOMOTIVE ENGINEERING, he will see that I recommend in that article that the headlight be covered, but not obscured. There is a distinction to be observed between covering the headlight and totally obscuring it.

While thinking about the particular collision which suggested the article on headlights, referred to by your correspondents, I was led to think that if this train that caused the trouble had been carrying green signals, or had been an extra train carrying white signals, the engineer of the approaching passenger train would have seen those signals, noted their location, and then been able to slow down his train sufficiently to prevent serious collision, or at least to prevent loss of life.

Where green signals are being carried on the front of the locomotive of a train, the rules do not permit their being covered whenever the train carrying them turns out to allow another train to pass. And although the headlight may be covered so as to be totally obscured, yet all approaching trains of superior rights seeing the classification signals, may know that there is a train on the passing siding. This knowledge is important in that it serves to make the engineer of the approaching train keep a sharper lookout for any possible irregularity that may be attending the train on the siding.

Although passenger trains, especially of the fast limited kind, are not required by the rules to respect freight trains with regard to the right to road, yet I can see no valid objection to the presence of such trains on any siding being known to the engineer of the approaching superior train. On the contrary, I believe that there are many good reasons why he should have such information—the wreck in question being one of them—and also that he should be required by the rules to slow down, unless he receives a signal from some member of the crew of the train on the passing siding that all is right with them.

The reason why the headlights are covered when the trains are in the clear on passing sidings is to indicate to other trains approaching from an opposite direction that it is standing on the side track, all in to clear and switches properly placed. If the headlight of a locomotive that is standing on a passing siding be not covered, then it is assumed by the crew of an approaching train that such train does not clear the main line, and the proper action is taken at once to bring the opposing train to a stop.

A headlight covered with a transparent material of some desirable color will mean

as much to the engineer of an approaching train as a headlight totally obscured. Now if in addition to the transparent covering placed on the headlight, a signal be required from the crew of the side-tracked train to assure the approaching engineer that all is right, a wreck such as mentioned in my communication concerning the covering of headlights in all probability would not occur. The knowledge of the presence of trains standing on side tracks, according to my way of thinking, is of more importance to trains of superior rights than if such trains were mere box cars. Box cars nowadays are generally placed on what are termed business tracks, and these tracks are provided with derailing switch, which it is the law to leave in position to derail the car, should it move toward the main track. Not much is heard nowadays of box cars running out on to the main track, and there causing trouble, although you occasionally see one on the ground at the end of a derailing switch.

As to present rules under which the movements of trains are controlled, being No. 1, as Mr. Baker seems to think, there is not, in my opinion, a field offering greater opportunity for achieving splendid results in railroad practice than that which is offered to those who have the improvement of the rules in their hands. The improvement of the rules governing the running of trains can furnish material for a much lengthier article than space here will permit.

Electric headlights will, as suggested by Mr. I. F. Wallace, go a long way towards reducing the likelihood of accident.

Setting the brake, as suggested by C. N. E., is an old precaution that used to be taken in the days of hand brakes, and it might not be a bad idea to revive it in these days of automatic air brakes. A good tender brake could be utilized to advantage for the purpose of holding the head end of the train from moving while trains are standing on side tracks.

Rules for movements of trains and the government of railway employés are necessary both for safety and for the protection of railway companies and their patrons, but the fewer they are in number the better for all concerned. Many of the rules we see to-day attached to the margin of time cards and issued in the form of bulletins, are impossible of strict compliance, and it is a question whether it would not be better to dispense with them altogether, or to substitute others that can be obeyed according to the letter and the spirit.

But men will forget rules, and will through forgetfulness disobey them, and for this reason means must be sought out to prevent such disobedience or oversight resulting in accident. It is for this reason that covering the headlight with a transparent curtain of some desirable color, and in addition calling for a signal from the side-tracked train, are suggested.

J. P. Kelly.

Advocating Fair Trade.

During the past two or three years American factories have been very busy with both domestic and foreign orders. Many manufacturers finding themselves unable to supply the increased domestic and at the same time large foreign demand, have gradually added to their equipment until to-day the productive capacity of their works is much larger than a few years ago.

Now a great trade depression has spread almost over the entire continent of Europe. As if this were not enough, the United States Treasury Department has entered upon a destructive tariff war with Russia, the largest and most promising foreign field for the sale of American manufactures.

Large quantities of machine tools, woodworking machinery and other manufactures were formerly exported to that country, but since the new Russian retaliatory duty of $4.77 per hundred pounds has gone into effect this trade has practically ceased. The American must now pay over 57 per cent. higher rate of duty—besides shipping his goods from five to six thousand miles farther—than the Germans, who copy and imitate all things American.

In shipping to France, America pays the maximum duty on all manufactures. On machine tools this is from 33⅓ to 50 per cent. higher than that charged Europeans. Germany is now preparing to check American imports into that country, because America seeks to sell her products in German markets while closing her own doors to imports by a prohibitive tariff.

The exceedingly hard times from which Europe is now suffering, together with the stopping of shipments to Russia, has greatly diminished the export of American machinery. Should there be any decrease in the domestic demand our manufacturers will find it exceedingly difficult to keep their enlarged works employed.

While times are still prosperous America should turn her attention to a rearrangement of her tariff and enter on broad and liberal lines into reciprocal trade relations with her foreign customers. There is scarcely an article which cannot to-day be produced better and cheaper in this country than abroad.

As Americans go to foreign countries and sell their products in the face of home manufacturers there, paying the long freight and duty, why should they be afraid to let those manufacturers come here and try to get an order once in a while? Foreigners will not permit Americans to longer usurp their markets without receiving some privileges in return.

Why, for instance, should England admit American wood and metal-working machinery free of duty, when we charge 45 per cent. duty on anything in these lines that she chances to offer us? If she can produce it better or cheaper than we can, her example, as exemplified by the imports, will sooner or later stimulate some of our restless, enterprising spirits to devise a way or means of manufacturing it even better and cheaper—not cheaper because of any less expense for labor, but by devising better methods or better machines to do the work.

G. P. Altenberg.

Cincinnati, Ohio.

OFFICE OF MR. A. M. WAITT, SUPERINTENDENT OF MOTIVE POWER, NEW YORK CENTRAL, GRAND CENTRAL STATION, NEW YORK.

Want More Work Out of the Engines.

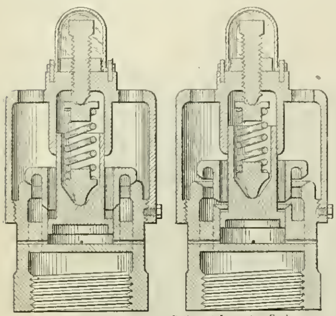
We have some 19½ x 26, ten-wheel passenger engines with 180 ounds steam and 68-inch wheels, that take from seven to nine cars over the division of 124 miles in three hours and make seven stops between terminals, two of which are five minutes each, and often we have to make an extra stop for water. It is impossible to make up much time on a three-hour schedule with these engines, but I often hear it claimed that they ought to handle twelve or fourteen cars and make the time.

I would like your opinion as to whether these engines do as much as they ought to. The division is very level and not much grade either way. S. B.

[We think the engines do very well, pulling seven to nine cars 124 miles in three hours, which is 41.33 miles per hour, and making seven stops. The stops will take away about 30 minutes, so that an average speed of 49.6 miles an hour is made. We consider that good work. What do our high-speed readers think about it? —Ed.]

New Safety Valve.

I am sending you drawings of an improvement in safety valves, as shown, which represents a double-seated valve guided by a dash-pot piston at bottom



IMPROVED SAFETY VALVE.

and spring case at top. By reducing the area of the exposed part of the valve, by means of the dash-pot a more delicate and sensitive spring can be use', and by the use of the combined valves provision is made to dispose of a large volume of steam if necessary by the steam gage, and its proportion may be such as to open and close at the same point on the gage. The small passages shown leading to the dash-pot provide for a relief of vacuum or compression.

A double burr reamer may be used to face the valve and seat without removing the base from the boiler or putting the valve in a lathe. The cap, being held by means of sealed pins, is of glass and may readily be broken if occasion should occur. My improvement in this claim over the one granted me January 15th last is that the steam in no way comes in contact with the spring. J. E. Osmer.

Clinton, Ia.

About Springs.

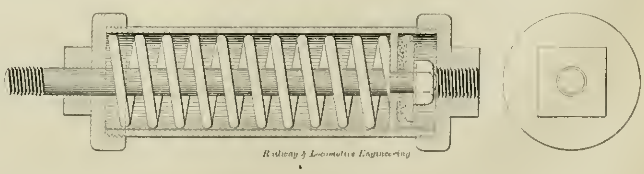
As spiral (or more correctly "helical") springs are used in the railway as well as other branches of mechanics, the experiments recently made by Professor Benjamin and Mr. R. A. French and presented to the American Society of Mechanical Engineers are interesting. Out of fifteen springs 9¼ inches outside diameter and 17¼ inches high before closing, the average set was 2 inches after the spring has been closed solid twice under a pressure of 75,000 pounds. No further set took place on being again closed twice, which indicates that a spring closed solid under heavy pressure should take all its permanent set with two closings. Practical application of these facts will occur to any shopman.

It was also shown that when the diameter of spring was small as compared with the size of the steel used, there was less set than with a larger diameter. This indicates that springs of small diameter may safely be subjected to a higher stress than those of a large diameter, the size of the steel remaining the same. There is a limit to this, however, as springs having too small a diameter as compared with the size of steel are subjected to such an internal stress in coiling as to weaken the steel. It is recommended that for good service the mean diameter of the spring should be at least three times the diameter of the steel from which it is made. The large bar must be heated to a higher temperature in working and in high carbon steel this may cause deterioration. Also in tempering the bath does not affect the large bar as uniformly as the small one, both of which facts help to explain why large springs are not always as satisfactory as small ones.

Pneumatic Belt Shifter.

Inclosed find blueprint of a pneumatic belt shifter which is very handy for shifting long belt. In the Grand Trunk shops at this place there is a long belt, 59 feet long, 2 inches wide, where the swinging of the belt would force belt from tight pulley to loose one. With the pneumatic shifter air is on piston while belt is on tight pulley, and holds it in position. A three-way cock is used for controlling air, and the length of cylinder is varied to suit width of belt. Use ¼-inch iron gas pipe and make hole in brass cap to suit travel of shifter, usually about 1-32 inch. Use cross-head on threaded end of piston and spring to suit belt. It can be placed anywhere. Arthur L. Smith.

Pt. Huron, Mich.



PNEUMATIC BELT SHIFTER.

Time Was Valuable.

Some years ago a man now way up in railroad circles held a position with the Central Branch road, just big enough to enable him to take a trip over the road now and then in a special car. He was somewhat of a poker player and occasionally would invite some of his friends who knew the game, to take a trip over the line with him. On one of the return trips his friends were getting into him in good shape. He was $400 or $500 loser. The train was within seventeen miles of Atchison and he knew there was no show for him to pull out even in the time it would take to run in. So he excused himself and went into the baggage car and pulled the air. The train came to a stop. He talked with the engineer for a few minutes. Then he went back and resumed playing. The train didn't move. The friends asked him what was the matter. He said that the engine had slipped an eccentric and he had telegraphed to Atchison for another engine. In a couple of hours, through some lucky plays, the railroad man got even with the game. Then he stepped to the platform of the car and yelled to the engineer: "Run like h—l into town. I'm even with the game." —*Kansas City Journal.*

Locomotives that are Hard to Inspect.

With a fair share of the large modern locomotives the engineer cannot get under them to inspect wedge bolts, eccentric strap and blade bolts. The wheels come very close together and driver brake rigging takes up all the openings we used to have between them. With small wheel centers you cannot see very much between the spokes, wheel hub and counterbalance; in fact, some of the bolts and nuts in the motion work are invisible to anyone not under the engine.

Now, in such cases it would prevent many engine failures on the road, if good, substantial wedge-shaped split keys were in every bolt, with a good bearing against the surface of the outside or jam nut. The small round split keys through the end of bolts that are usually located some distance from the jam nut are worse than useless, for they will not prevent a nut working off and are only in the road.

Wide split keys cost more than the infant size of split keys; but one breakdown will cost more than all the bolts and wide split keys for the whole engine.

We think it only fair that in the case of engines that cannot be properly inspected unless over a pit, a regular inspector be detailed to go under the engines after they are placed over the pit and examine every part of the engine that cannot be seen from the outside.

Safety calls for a thorough inspection as a preventative of failures on the road, and safety for the engineer calls for a proper place to inspect the engine. It surely is not safe to go under an engine in a crowded yard with hostlers moving engines here and there, or feeding them down in their turn to the coal chute, sand house or cinder pit.

The argument is sometimes used that if an inspector is charged with the duty of looking after any special part, the engineer will not pay any attention to that part, even when on the road, and that any division of the responsibility for locating defects cannot be made. The science of railroading is the shifting of responsibility on the other fellow, but that part of the science comes *after* the break-downs.

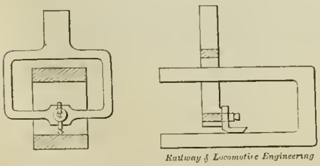
What we want is putting the responsibility on the proper man *before* the breakdown. This cannot be put on the man who brings the engine in; he has made his trip all right. The man who takes the engine out rarely gets a chance to thoroughly inspect the machine; he must have a faith as large as a mountain to give him an idea that everything is all right.

JOHN W. TROY.

Indianapolis, Ind.

Planing Conducting Rod Straps.

My note book contains a sketch of a planer tool, or, rather, tool holder, for use in planing connecting-rod straps or similar work. It is, of course, an alternative of the side tool and has the advantage of using a regular tool instead of one specially forged. If the set-screw went in at the side—or, better yet, there was a wedge-bolt arrangement—so that the tool point need not be forged so long, it



ROD PLANER TOOL.

would be better. Unfortunately there is no credit given in the note book so that I can only say it is not original with me but has been picked up somewhere in my travels.

F. C. HUDSON.

Tombstone, Arizona.

Using Injector to Cool Hot Boxes.

The description, in your September number, of Mr. McBain's device for cooling hot bearings, reminds me that we have in use on all our large passenger and freight engines an arrangement which is thoroughly efficient for the purpose of cooling hot driving and engine truck boxes. We take the water directly from the injector delivery pipe, and while it might be supposed that water as hot as this would not do much cooling, still, as a matter of fact, it does the business so successfully that we never think of losing a minute, and in fact, if necessary, always make up time on our fastest schedules while using the cooler.

The arrangement consists of a line of ¾-inch piping running around the engine directly underneath the frame in the shape of a letter "U," with the open end in front terminating in a globe valve waste cock in front of each No. 1 engine truck box.

Connection to this pipe is made by a ⅜-inch pipe tapped into each delivery pipe directly ahead of the injector, chocked to ⅛ inch at the top and leading directly down to the ¾-inch pipe below, opened and closed by a globe valve in upper end.

Connection is made from the ¾-inch pipe to each driving and engine truck box by means of ½-inch hose connected to the inside end of the cellar by nipples, into which are screwed from inside the cellar bent pipes which extend along the bottom of the cellar to the middle, where they rise on the side just as high as possible without touching the journal. Each hose is closed by a globe valve.

The cooler may thus be operated from either or both injectors, and will throw water sufficient for one or all the boxes on the engine. These hose are securely clamped to nipples to prevent being forced off by pressure.

A 3-16 inch hole is drilled into the under side of each end of the main water line, from which there is a continuous flow of water while in operation. This insures a circulation of water throughout the pipe and prevents freezing.

A ⅜-inch steam pipe, closed by a globe valve, is also run from the boiler to the water line, which is used as a heater while cooler is not in use. The method of using it in freezing weather is to open the waste cocks in ends of the water line until all water is blown out, after which they are closed and sufficient pressure maintained to insure a free flow of steam through the 3-16 inch vent holes.

You have thus a cooler always ready for use at a moment's notice, and one which will handle any hot box at any speed.

It might be supposed that the use of this would naturally increase the number of "hots" and the number of chronic bad ones, but we do not find it so; rather the contrary, since the use of the water in the cellar permits of the bearing being at the same time freely oiled on top, so that, as a rule, a bearing on which the cooler has been used will come in in such condition that after being sponged it will run on the next trip without any further heating.

O. M. FOSTER,

Collinwood, O. L. S. & M. S. Ry.

A RELIC OF THE MORMON RAILWAY—A PICTURE SENT BY ONE OF OUR FRIENDS.

Railway Mechanical Conventions.

The Joint Committee of the Master Car Builders' and Master Mechanics' Associations met at Buffalo on December 11th to decide on the place of meeting for next annual convention. There were present, representing the Master Car Builders' Association, J. T. Chamberlain, J. J. Hennessey, J. W. Marden, F. W. Brazier, W. P. Appleyard and E. D. Bronner. The Master Mechanics' Association was represented by A. M. Waitt, George W. West and Angus Sinclair. Representatives were present from hotels at Old Point Comfort, Thousand Islands and Saratoga, and they were permitted to explain to the meeting what attractions they had to offer. A subcommittee had recommended Saratoga, and the Joint Committee voted to hold the convention there. The Master Car Builders meet on June 18th, and the Master Mechanics on June 23d.

It is a common thing for Marshall's big six-coupled passenger engines to haul a train of about 700 tons behind the tender at a speed of 60 miles an hour. The Lake Shore & Michigan Southern is a very level road, but 700 tons of passenger cars bound firmly together need huge power for starting and keeping it going at high velocity.

Wireless Telegraphy.

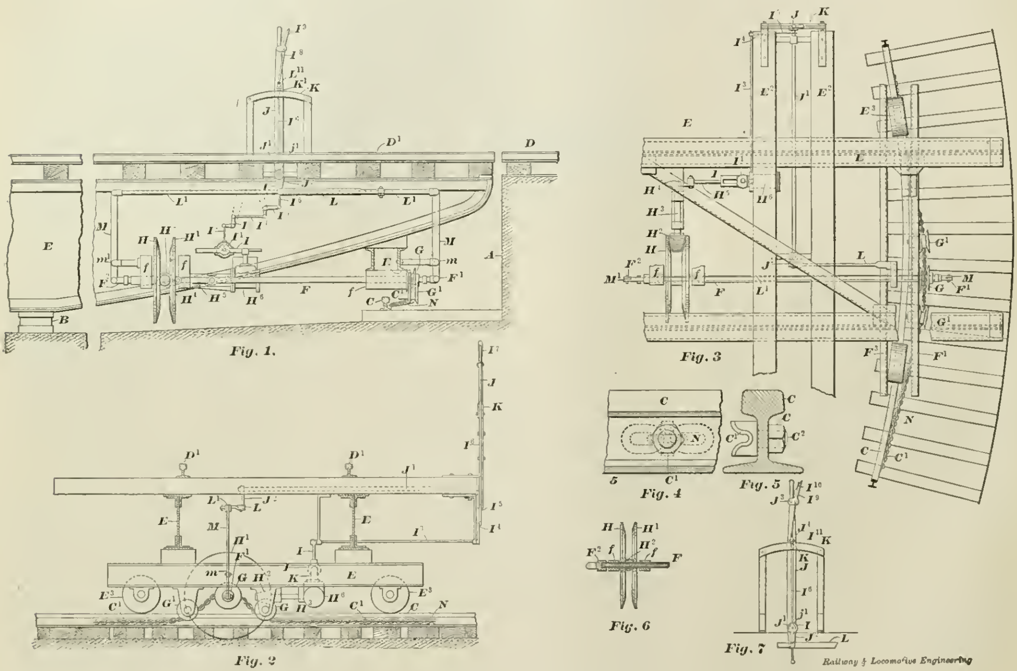
The Marconi system of wireless telegraphy, which the inventor has been experimenting with for eight or ten years, has made great progress lately, and it is now used for sending telegrams between passing vessels at sea and from ships to lighthouse stations, whence they can be transmitted to any point reached by ordinary telegraph or cable. Marconi has always insisted that he would eventually send messages across the Atlantic by his wireless system, and he has lately been experimenting from Newfoundland, with the expectation that he can send messages to a place in the British Isles. His friends claim that he has sent messages from Newfoundland that were received on the coast of Cornwall, England. The Anglo-American Telegraph Company, which has a monopoly for sending and receiving cable messages in Newfoundland, attempted to stop the Marconi experiments, without success. Thomas Edison has tried to discredit the value of Marconi's invention but the messages have not refused to move because that great electrician of supreme claiming capacity has frowned upon them.

Beamer's Turntable Motors.

As may be seen from the illustration, this motor is placed entirely below the floor of the turntable, being represented by *H6*. On the one used by the Pennsylvania Railroad at Tyrone this is an ordinary slide-valve engine with a 3x4-inch cylinder using compressed air. Air is supplied through the center of the table by an overhead pipe connected with a swivel joint. The engine drives a small friction cone *H2*, which in turn drives the friction disks, either *H* or *H1*, according to the direction in which the table is to be moved. These disks drive the shaft *F*, which carries a pulley *G* having recesses in its face so as to engage the chain *H*, which is around the turntable pit outside the rail *C*. This chain is of course stationary, being fastened to the rail by bolt extensions *C2*.

The device is controlled by lever *I* through the connection shown and the fact that a turntable of this kind has been worked successfully for over two years proves its practicability.

The cost of operation is $2.88 a day, as against $5.76 when the table was turned by hand. There is, however, nothing to prevent it being operated by hand if necessary, as the motor is no encumbrance beyond its weight.



BEAMER'S TURNTABLE MOTOR.

We have received several inquiries about a Railway Correspondence School with headquarters at 304 Broadway, New York. The writers say that they subscribed for a course of lessons, but did not receive them and that letters sent to the concern are not answered.

To Join New York and New Jersey.

One of the most stupendous engineering enterprises ever undertaken is promised by the Pennsylvania Railroad Company in connection with carrying the Eastern terminus of that great railroad into New York city. To our numerous readers who have never been in New York city we might explain that what is known as New York city proper is built upon Manhattan Island, an irregular strip of land, about 11 miles long and from 1 to 2 miles wide. This island is separated from the State of New Jersey on the west by the Hudson River, which is about 1 mile wide, and it is cut off from Long Island, where Brooklyn is built, by the East River, which is an arm of the sea.

All the railroad companies from the West and South that have New York for their Eastern terminus, except the New York Central, end their land route in New Jersey, and the Hudson River—popularly known as the North River—has to be crossed by ferryboat. Although the boats engaged in this business are the finest of their kind in the world the water trip is regarded as a nuisance for beginning or ending a railway journey. There have been numerous propositions to build a bridge across the North River, but nothing practical has come out of them—principally because the authorities and the politicians of the States of New York and

New Jersey never could agree upon an acceptable division of the spoils that would be harvested from such a great engineering enterprise. One tunnel was driven for a considerable distance under the North River for the purpose of connecting Manhattan Island with New Jersey, but some unexpected engineering difficulties were encountered, the company doing the work became bankrupt, and nothing has been done for twenty years.

When the people of New York were beginning to despair of ever seeing a land connection made above or below the Hudson, President Cassatt, of the Pennsylvania Railroad Company, announced that his company intends tunnelling not only the North River but the East River as well, thereby pushing a land connection to the far-reaching lines of the Long Island Railroad. Two years ago the Pennsylvania Railroad Company secured the controlling interest in the Long Island Railroad, so it looks as if in the near future the Pennsylvania Railroad will provide unbroken rail transit from its far-reaching Western and Southern connections to the most easterly point of Long Island.

The late Austin Corbin, who for years practically owned the Long Island Railroad, nourished for a long time a pet scheme to build a great harbor on the eastern point of Long Island, which would accommodate the largest steamboats afloat and make that the passenger terminus for transoceanic travel between America and Europe. Death took him away while Mr. Corbin was working on this great problem, but it may be that the Pennsylvania Railroad Company, with its unlimited resources, will yet establish the harbor and the reduced ocean voyage which proved beyond the power of a private individual. Mr. W. H. Baldwin, Jr., president of the Long Island Railroad, denies that the Pennsylvania Railroad Company, whose interests he represents, intend undertaking the great harbor sche e, but that may come later.

The tunnel will pass under the bed of two rivers into which flow the cean currents, and thence under the city of New York, with an underground terminus near Thirty-fourth street, between Seventh and Eighth avenues. A quarter of a century ago such a scheme would have been dismissed as practically impossible, and even within the past few years that it has been under discussion there has not been lacking expert opinion to declare the venture impracticable and visionary. But so rapidly has engineering and construction advanced that the Pennsylvania Company have declared that the work will be undertaken and pushed rapidly to completion. Building railroads over and through great mountains has given the engineering world practice that does not hesitate on the banks of two great rivers.

To the public the improvement will be one of vast importance. It is over the lines of the Pennsylvania that a very large portion of the travel from the South and West reach New York. Under the present terminal system a ferry voyage is necessary to reach the city from the Jersey side. This course not only involves delay, but inconvenience and discomfort. With lines running directly into the heart of the city, the public will be saved both the necessity of a change to ferry boats, but will avoid the inconveniences and discomforts that necessarily arise from the present method. The outlined plans are stupendous in character, but modern engineering skill can carry them to a successful finish.

A Heavy Suburban Locomotive.

The accompanying illustration shows a locomotive for suburban work, which has been in use on the New York Central & Hudson River Railroad for some time. As will be seen, it is a very heavy engine of this class and has piston valves. It was built at the Schenectady works of the American Locomotive Company, and the principal dimensions follow:

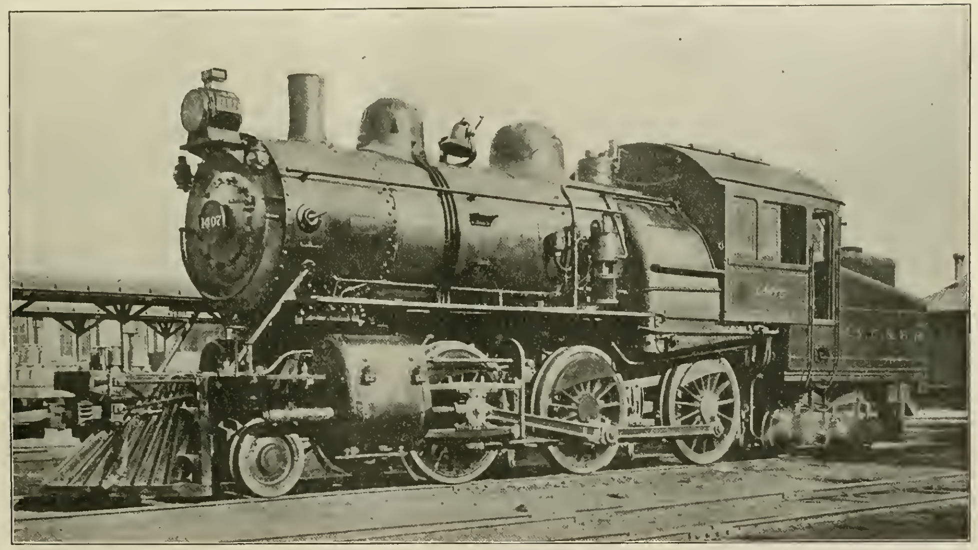


Photo. by F. W. Blauvelt.

A NEW SUBURBAN ENGINE OF THE NEW YORK CENTRAL.

Cylinders—20 x 24 inches.

Driving wheels—63 inches.

Truck wheels—30 inches.

Weight on driving wheels, total—141,000 pounds.

Total weight in working order—226,400 pounds.

Rigid wheel-base—15 feet.

Total wheel-base—35 feet 9 inches.

Diameter of boiler—70 inches.

Tubes—Number, 365; diameter, 2 inches; length, 12 feet.

Size of firebox—90 inches long, 102 inches wide.

Total heating surface—2,432 square feet.

Steam pressure—200 pounds.

Fuel—Anthracite coal.

Capacity of tank—Water, 3,500 gallons; coal, about 4 tons.

Railway and Locomotive Engineering

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A Steam Jet the Best Draft Inducer.

One of the most important discoveries made by the pioneer experimenters with the engines from which the locomotive was evolved was the fact that passing the exhaust steam through the chimney of a boiler produced an artificial draft which greatly increased the capacity of the boiler to generate steam rapidly. The discovery was made accidentally, and there is great conflict of opinion about who was the fortunate engineer to fall upon that accidental discovery; but certain it is that the stimulating of the fire by exhaust draft was quickly recognized as effecting a great improvement upon the locomotive. The far-seeing men among the pioneer engineers regarded exhaust draft as one of the two most important principles in the design of a high-speed locomotive. The other very important principle of design was the multitubular boiler.

There are certain objections to the using of exhaust steam for creating draft that have been greatly magnified at times, and various attempts have been made to produce stimulation of the fire by other means, but they have always ended in failure. Some people think that the draft-creating work could be performed better by means of a fan; but that has been tried a great many times and every attempt to employ fans has ended in immediate failure or in the rejection of the apparatus after it had been worked long enough to demonstate that the use of fans was less efficient and more costly than the use of exhaust steam.

We have been moved to take up this subject now because of a prediction that was lately made in a paper read at the Western Railway Club. While discoursing on combustion, the author of the paper says: "In obtaining fuel we must take what Nature has provided for us, but in supplying oxygen man's skill is called into play. This important gas oxygen is a part of the air, being about one-fifth of it by volume. Since it may be had for the taking, the engineman's source of supply is the air, and the extraordinary demand is met by an induced draft. At present this draft is produced by shooting the exhaust steam into the stack. Objections to this method are back pressure in the cylinders and the almost absolute dependency of the strength of draft on position of reverse lever or cut off. This latter objection frequently manifests itself, to the discomfiture of the fireman and also in the loss of fuel. The economic considerations of the present warrant the prediction that another method must supplant this one. . . As a concluding statement, permit the prediction that inherent objections to the present method of draft and the present form of fuel make a change in both necessary."

With all due respect to the learned professor who wrote these words, we should like a bill of particulars telling us what he would substitute for the exhaust-producing draft and how the superior results would be obtained. If he, and others who find fault with exhaust steam draft, would study the subject carefully, they would find features about the exhaust-induced draft that cannot fail to excite the admiration of every unprejudiced student of steam engineering, and particularly that part relating to draft appliances. It is true that the strength of draft is dependent to a great extent upon the point of cut-off; but at the same time the point of cut-off measures the volume of steam passed into the cylinder, and consequently regulates the demand made upon the boiler. On this account the action of the exhaust steam as a draft producer is regulated automatically.

In his experiments with the locomotive in the engineering laboratory of Purdue University, Professor Goss found things to admire which had previously been regarded as objections to the draft action of a locomotive boiler. He wrote concerning tests made: "In any boiler the condition of draft determines the rate of combustion, and consequently under ideal conditions the draft will be a function of the rate of combustion. But under conditions actually affecting the action of the boiler of a locomotive, there are variations in this relationship. The precise action of the steam jet in producing a draft action depends upon the pressure of the exhaust steam. The capacity of the jet as a means for producing draft is nearly proportional to the weight of steam discharged per unit of time; whether the discharge is in the slow, heavy puffs incident to slow speed, or in light but more rapid impulses, is not material. If the weight of steam discharged is the same, the draft action is approximately constant."

No means of forced draft has ever been devised that would approach in efficiency the action of the steam jet in inducing the proper amount of action on the fire to meet the varying requirements of locomotive service. Apart from their mechanical shortcomings, there was always difficulty in regulating force-draft appliances to generate steam in the volume required by the cylinders. The domestic bellows which was once a valuable adjunct in every household, high and low, and was used to blow up the fires that cooked the dinner and heated the dwellings of rich and poor, was the prototype of the artificial draft-creating appliances used on early locomotive engines. The discovery of the merits of the steam exhaust as a draft creator discredited the humble bellows as a locomotive fire stimulator, but its favorite progeny, the fan, has done service on locomotives at various times and tried, without success, to supplant the exhaust jet.

When the Liverpool & Manchester Railway Company in 1829 offered a prize of £500 for the most successful locomotive, an engine entered for the contest by John Ericsson had a fan to stimulate the fire, and the repeated failures of this fan were the means of the prize being awarded to George Stephenson's "Rocket," instead of to Ericsson's "Novelty," which was the favorite. It is a curious subject of speculation to throw the imagination afloat and think out how the pages of history would have been changed had Ericsson's annoying fan consented to do its work until the contest was over, and Ericsson, the winner of the prize, stood ready to grasp the riches and honors that awaited the successful locomotive designer. He would have found a permanent sphere of activity in Great Britain and would not have found it necessary to come to America in search of a livelihood. Then there is likelihood that he would not have worked out practically the problem of screw propulsion for steam ships, and the "Monitor" would not have been built to explode the belief that "wooden walls" were the kind of man-of-war capable of successfully defending the shores of every nation.

When Ericsson in England was lamenting his bad luck with a fickle fan, Peter Cooper in the United States was demonstrating to the stockholders of the Baltimore & Ohio Railroad, with his "Tom Thumb" locomotive' that an engine could be made to run around the sharp curves for which the railroad named was noted. He also used a fan as a fire stimulator, and got into various embarrassing plights by failures of the draft-creating appliance. The success which he achieved with the tiny engine had strong influence on the motive power afterwards built for the road, and the first regular service engines

introduced on the Baltimore & Ohio Railroad were equipped with fans for creating draft, and they remained in use for several years. The fan had its adherents and advocates, and there raged for a time in Maryland and Pennsylvania a mimic war between the friends of the fan and those who swore by the steam jet, but the steam jet triumphed in the end. This did not happen because the jet had the most powerful friends; it happened because the fan was not so efficient as the jet. Inventors are notorious for overlooking the history of old inventions, and they have repeatedly put a little transitory life into fans for creating draft in locomotive fireboxes by the force of Unite States patents; but even that artificial stimulant left them deserted and forlorn under the depressing ordeal of practical application.

Honor Where Honor is Not Due.

When the American Society of Mechanical Engineers met in New York last month a portion of the members took part in the unvailing of a monument to Robert Fulton, which was erected in honor of the reported inventor of the steamboat. There are many men whose memory is revered for achievements they did not perform—they constitute a whole army of shams, but none of them has received so much undeserved praise as Robert Fulton.

When we reflect upon the honors heaped upon an engineering charlatan like Fulton, we naturally survey the work done by others credited with great inventions and we are almost inclined to exclaim, "the awarding of fame is a delusion." We think of James Watt, the *improver* of Newcomen's steam engine, and find his name accorded the highest honors as the *inventor* of the steam engine. We move forward a few years and come to the name of George Stephenson, who is called the *inventor* of the locomotive. When the claims that Stephenson invented the locomotive are closely analyzed and scrutinized we find that no proof exists of Stephenson having invented anything of value that improved the locomotive. His first engine was an inferior imitation of one built by William Hedley, and all the subsequent improvements were the work of other inventors.

But Watt and Stephenson did great work which entitled them to the admiration and gratitude of mankind. Watt by his wonderful inventive ability and engineering intuition converted a crude, slow-moving, irregular-acting machine into a perfected engine that was capable of giving steady motion to the most delicate forms of machinery.

George Stephenson was deficient in inventive attributes, but he had the faculty of knowing a good thing when he saw it, and he perceived that railroads would at some time become the principal means of land transportation. He also clearly saw, long before others did, that a form of portable steam engine would be the future motive power of railroads. Stephenson was a good representative of the best type of Englishman. Opinionated and ever pushing his opinions with bulldog persistency, he made weaker minds yield to his views on railroads and locomotives. That was his hobby and he rode it so furiously that the British world was drawn along by induction against its will very often. Stephenson by his vigorous personality and convincing arguments prevailed on British capitalists to construct a railroad for passenger business. Against great odds and violent opposition he induced them to try locomotives for motive power, and thereby gave his native country the honor of originating steam-operated railroads at the moment when America was almost ready to grasp the prize.

Watt and Stephenson both performed work that entitles them to high honor, but Fulton did nothing but act as a draftsman to put other men's ideas upon paper. Being a painter by profession, he became without difficulty a skillful draftsman when he devoted his attention to engineering. A great many inventors had worked on the problem of propelling boats by steam before Fulton's time; and it was only through want of financial support that some of them failed in attaining commercial success. As early as 1690, Pepin, a celebrated French savant, who is credited with inventing the boiler safety valve, proposed using steam to propel vessels. He built a small experimental vessel for the purpose, which was destroyed by a mob of boatmen who saw in the embryo steamboat a dangerous rival of their business. In 1736, Hull took out a patent in England for a steam-propelled boat. In 1752, the French Academy of Science awarded a prize for the best essay on the manner of impelling vessels without wind. After that European scientific journals frequently published articles on steam propulsion of vessels. That agitation of the subject brought into the field inventors in France, Great Britain and the United States who performed the preliminary work of designing a practical steamboat.

The most successful among those inventors was John Fitch, a Connecticut mechanic, who built several steamboats which worked successfully. Failing to obtain the help in the United States for pushing his steamboat enterprises, Fitch went to France, which Americans were at that time in the habit of looking to for aid in all kinds of schemes. He did not receive the expected encouragement and returned to America, leaving with the American Consul at Havre the plans of what he considered the best form of steamboat. These afterwards fell into the hands of Robert R. Livingston.

A few years afterwards Robert Fulton entered the steamboat field. He was much more forunate than his predecessors and contemporaries in securing influential and financial support. Robert R. Livingston, who had been for years American Minister to France, took a warm interest in the work done to apply steam to boat propulsion. He met Fulton in Paris, where schemes for steam propulsion were rife, and finding Fulton very skillful in sketching the mechanical appliances developed by the various workers in the steamboat field, took Fulton under his powerful influence. Livingston had secured from the legislature of New York a grant of the exclusive right of using steamboats on the navigable waters in the neighborhood of New York city and he was determined to reap the benefits from the privilege conferred.

Livingston sent Fulton to New York provided with drawings and models of the most approved steamboat machinery and also sent him a Watt engine and boiler suitable for use in a steamboat. Fulton made no progress with boat or machinery until Livingston returned to New York. The personal energy of Livingston was immediately thrown into the steamboat building scheme and a successful boat was soon ready for business. The success of the "Clermont" is popular history.

Livingston was all to Fulton that Boulton was to Watt and a great deal more, for he not only provided the necessary capital, but the greater part of the energy and much of the engineering acumen. Fulton acted as superintendent for Livingston and secured all the honor and not a small part of the profit.

Watch the Igniting Temperature.

In discussing the well worn subject of locomotive combustion recently at a railway club meeting, a college professor of chemistry follows very clearly the most important operation connected with the burning of coal in a locomotive firebox. He deals principally with three things essential to combustion, viz.: the fuel to be burned; oxygen, the supporter of combustion, and the igniting temperature of the fuel. The constituents of the coal are plainly described and the necessity for supplying the necessary oxygen to burn the elements in the fuel in such a way that the full measure of their capacity for producing heat will be obtained. Then he dwells on the necessity for keeping the fire at the high temperature required for the coal to be burned properly.

It might be supposed that the practical men who perform the work of firing locomotives would profit most by the information given concerning the supply of oxygen necessary to produce perfect combustion of the various elements composing the fuel. They ought to be made better firemen from knowing the relative volumes of air necessary for entering into combination with carbon and with hydro-carbons and the magnitude of the losses that result from deficiency of the oxygen which is taken from the air supply. We think, however, that the spreading among firemen of knowledge of the loss that results from parts of the fire being permitted to fall below the igniting temperature, is

likely to impart more heat-saving information than explaining the chemical action of combustion is calculated to impart.

The practice becoming so common of examining firemen on questions relating to combustion has made the study of the elementary chemistry, wherein the phenomena of combustion are explained, very common among firemen. From letters received, we are aware that many of them, whose knowledge of grammar is very rudimentary and whose orthography indicates that they missed the training of the rustic spelling bee, can explain the science of firing nearly as well as a chemistry professor could do it. Strangely enough, however, we find that there is a tendency to overlook the importance of what may be considered the physical feature of combustion—that is, keeping the temperature of all parts of the fire at all times up to the igniting temperature. If any part of the load on the grates falls at any time below the temperature at which coal or hydro-carbon burns, there will be loss of heat, for the gases will pass away unconsumed, and some of them have the most valuable heat-producing properties. There are two ways by which a portion of a firebox may be permitted to fall below the igniting temperature. One is by heavy firing, which will put such a thick layer of coal on the whole or part of the grate as to smother the fire for a time. The other way comes from very light firing, when portions of the grate carry so little fuel that more air passes through than what can be mixed with the fuel gases. Both these are defects of firing that are as wasteful as other examples of bad firing.

Advising the Young Mechanic.

This is usually a difficult problem to employers, professional men and others to whom young men come for advice, and many have this question to solve from time to time. It is a good rule that "he who helps another to help himself helps him best." The American School of Correspondence, Boston, Mass. would be pleased to correspond with parents and others who are not acquainted with their plan for helping a young man to help himself. Through the generosity of its founders and of several prominent manufacturers interested in the better technical education of their men, the trustees of this school are able to offer each year a few free scholarships in the engineering courses to deserving, energetic and intelligent young men.

The scholarships for 1902 are now at the disposal of the trustees, and applications will be considered from the readers of this paper. The course of study offers thorough instruction at home in mechanical, electrical, stationary, locomotive, marine and textile engineering, as well as heating, ventilating, plumbing and mechanical drawing, under instructors who are graduates of the great technical schools. Much of the instruction is under regular teachers in the technical schools for which Boston is famous.

To the young man who has lacked the time and money to fit himself to be a master in his trade, this opportunity opens wide the doors to advancement and success. Though he may live hundreds of miles from an educational center, he nevertheless enjoys many of the advantages of the student paying for tuition in the great technical schools.

Switching Air-Braked Cars Ahead.

One of the most emphasized points in air brake construction is that all air-braked cars shall be switched to the head end of the train, next to the locomotive, coupled up and operated. This instruction, however, has been met with considerable opposition from yard masters and the transportation department, inasmuch as the placing of the cars in station order has been considered paramount to the arrangement of the cars in the train in such order that all air brakes may be available for use. Of course, the objections raised to switching out a car or two from the rear portion of a long line of twenty-five or thirty cars, held on to by the engine, are well taken. Switching of this nature endangers the lading of the cars and also the draft gear attachments, and is not nearly so easily done as if the cars to be thrown out were right next to the engine, where they could be switched out without handling any other part of the train. This feature may be considered unduly important and receive too much support. But one important fact should not be overlooked, and that is, that the assured safety of the train in transit, such as is obtained by coupling up and using all air brakes, is of much greater importance than the greater facility in throwing out cars while switching, as above mentioned.

The frequent result of the failure to switch all air-braked cars ahead is that ofttimes a single non-air car, billed to a nearby point, may be placed next the locomotive, thereby cutting out a group of several air-braked cars which might otherwise be operated, but for the interference of this single non-air car. Happily, this state of affairs is rapidly passing out, and the regulation necessary for the cure has presented itself, and is acting automatically, slowly at present, but surely. The large capacity steel cars, where it is possible, are nearly always placed forward in the train, ahead of older and lighter capacity cars. The modern steel car is invariably equipped with air brakes and, being near the engine, is coupled up and used. Therefore the heavy cars with air brakes naturally find themselves at the head end of the train, and lighter and non-air-braked cars fall in their natural place, to the rear.

The automatic feature which is bringing the air-braked cars to the head of the train, is that the heavier cars, built of steel and able to stand rough usage, uncomfortably jostle the lighter cars, which are frequently unable to stand rough usage and keep company with the heavy steel car and still heavier locomotive, and the result is that the lighter cars find themselves oftener now than formerly on the repair track, finally finding their way into the scrap heap. This gradual but sure course of destruction of the lighter car may at first seem expensive; but upon consideration it will be found that the increased advantage gained by the use of the greater capacity cars taking the place of the lighter cars, and their consequent greater earning capacity, very much overbalances the loss due to the relegating of the lighter car. The law of the survival of the fittest is placing the modern-built and air-braked cars on the head end, next to the locomotive. The same law has created a scrap heap for the older form of car which was held to be good enough for a few years' more service, but not quite good enough to be fitted with an air brake. Thus the air-braked cars are finding themselves on the head end of the train and the lighter cars drift to the rear, and finally to the scrap heap.

Paying for Improved Shop Methods.

Every shop has a number of improved devices for turning out work which are due to the ingenuity of the workmen, but the question of remuneration for these is too often overlooked. If a device is valuable enough to be adopted it is because it is a saving to the company and there should be some method of paying a man for his work or of letting him share in the savings. Credit for the device is a good thing (and many fail to receive even this), but glory of this kind doesn't pay house rent or buy shoes for the children.

Where the piece-work system or some of its modifications are in operation, the inventor receives his reward at once in the increased earnings, and this should hold true in any case. Some shops allow a percentage of the savings for a given time after deducting the cost of making the device and something of this kind seems the fairest kind of a solution. In this case it should hold good whether he remained in the employ of the company or not, as his device would be earning money for them.

An incentive of some kind—and there is nothing more attractive than good, hard "coin of the realm" or its equivalent—is a great inducement for the devising of such tools as will assist in getting out the work. The co-operation of the men in such matters will do much toward increasing the output at a reduced cost.

Three years ago we got into considerable trouble for publishing an article describing the methods of firing followed on a railway where soft coal was burned with almost an entire absence of black

smoke. The article gave rise to a heated controversy, many enginemen contending that the thing was impracticable, while many others took the small revenge of "stopping the paper." Those, however, who were most opposed to the improved method of firing had the conviction forced upon them that the volume of smoke poured into the atmosphere by locomotives could be reduced by a little care and the result was that the smoke nuisance was greatly abated on many railways. During a recent extended trip we noticed on quite a number of roads that the firemen had grown weary of well-doing and were backsliding into the old dirty ways. In the big train shed of the St. Louis general station we noticed some of the worst nuisance cases we have ever witnessed.

BOOK NOTICES.

"Practical Electricity, with Questions and Answers." Price $2.

A book for those who wish to add to their knowledge of electricity in a practical manner and to become familiar with the terms and calculations. Its nineteen chapters seem to include about everything that anyone needs to know, from wiring to alternating currents. Illustrations are used freely, and such tables as are needed are found in convenient places. A list of questions follows each chapter, and answers are given toward the end of book. About 150 pages are devoted to electrical words, terms and phrases, so that the reader can readily find exactly what any word means, and so be sure of his ground as he proceeds. There are nearly 450 pages and 87 illustrations, the whole being bound in flexible leather with round corners, making it handy for the pocket. It seems to be complete in almost every way, and should find favor with all who desire information along these lines.

"Linear Drawing and Lettering." By J. C. L. Fish. Published by the Author, Palo Alto, Cal. Price, $1.00.

Although not a large book it is one of the most complete and sensible that we have seen as an instructor for those who wish to work out their own courses in mechanical drawing. The hints regarding the instruments, as well as the sketches showing the proper methods of inking are valuable to anyone.

The course in lettering goes into details of the construction of letters very thoroughly, and will be appreciated by those who realize the value of good lettering. While it does not make a drawing any more accurate, nothing adds more to the attractiveness and neat appearance of a drawing than a neatly lettered title.

The author also issues a Blank Book for Lettering to be used in connection with the other book and which sells for 25 cents. It is ruled so that almost any style letter can be easily and correctly drawn and will give valuable practice to any student of the other book.

Fast Speed with Electric Cars.

A series of very thorough tests were made in Prussia last summer to demonstrate the high velocity to which railway trains could be run by electric propulsion. It was predicted that the speed would reach 200 kilometers per hour, which is over 124 miles per hour, but the actual performance fell very much short of that speed. The work was done by a committee of experts, and they were given every facility that would aid them in attaining the highest speed that the machinery and track would stand. Two cars were used, and the trials began with a speed of 60 kilometers, which is 37 miles per hour, and this was gradually increased until a speed of 160 kilometers per hour was reached, which is close upon 100 miles, or in exact figures 99.44. This is a higher speed than was ever previously recorded on a European railway, and there is no certain record of a higher speed having been reached on an American railroad.

In pushing the two cars on the Prussian railway to the speed mentioned the electric current in the conducting wire amounted to more than 10,000 volts. When the velocity named was attained it was considered that the track needed strengthening before greater speed could be safely attempted.

Railroad commissioners are famous, or rather notorious, for interfering with railroad matters in a general way which they do not understand anything about, but the Texas railroad commissioners appear to have gone beyond anything in this line ever done before. One of their latest proclamations is that trains in Texas must be on time. The best class of railroad officials have been laboring very hard to bring this desirable result about, but the Texas commissioners, who seem to be of the class spoken of in the saying that "Fools step in where angels fear to tread," have assumed to take the matter into their own hands. Among the regulations that this precious board wishes to have carried out is one prohibiting passenger trains from waiting for other trains at junction points longer than thirty minutes, and a lot of other silly regulations. The railroad companies can stand the rule of not holding their trains at junction points very comfortably, but it will soon make a lot of furious people in Texas, who are liable to go for the scalps of their stupid railroad commissioners.

Illustrations have been drawn to show the details and methods of operation of a marine steam turbine designed by Col. John Jacob Astor, who, after giving much thought to the subject, is convinced that the steam turbine is capable of improvements, which will overcome some of the difficulties inherent in the present type. Col. Astor has applied for patents in the United States and the principal foreign countries.

Heat and Motive Power.

BY ANGUS SINCLAIR.

FIFTH PAPER.

GAS ENGINES.

Many experiments were made during the first half of last century to produce an engine that would be operated by the energy of coal gas, but very meagre results were attained, and it was not till after 1862 that a gas engine was built which furnished a fair promise of being worth using for motive power purposes. As early as 1826 Brown, an English inventor, brought out what was called a gas vacuum engine, in which a charge of gunpowder was employed in connection with water condensation to produce a vacuum. The engine was very clumsy and unreliable, but it possessed the merit of being the first gas engine to perform practical mechanical work.

Before proceeding to give particulars about modern gas engines it might be seasonable to explain something about the principle on which such engines derive their power. Gas engines operate by the mixture of hydro-carbon gas with air in the proportions that produce an explosive charge. All explosives are substances containing combustible elements which are mixed with other substances containing the oxygen necessary to effect instantaneous or exceedingly rapid combustion. We may use coal gas, kerosene, gasoline or other hydro-carbon and burn it slowly by supplying from the atmosphere the air necessary to effect combustion; but if we mix the gas of any of these compounds with atmospheric air in the proportion that the gas would require for combustion, keep it in a confined vessel and heat the mixture to the igniting temperature, the combustion resulting would be so rapid as to constitute an explosion.

In the furnace combustion of coal, the fuel gives forth carbon and hydrogen gas, according to the constituents of the coal. For every pound of carbon and of hydrogen burned a certain volume of air must mix with the fuel gas to effect perfect combustion. This air is composed of 1 part, by weight, of oxygen to 3½ parts of nitrogen. Carbon combines with oxygen in the proportion, by weight, of 1 to 2⅔ pounds, and hydrogen with oxygen in the proportion of 1 to 8, by weight. We therefore require in the combustion of 1 pound of carbon and 1 pound of hydrogen:

Carbon .....$1 + 3\frac{1}{2} \times 2\frac{2}{3} = 12$ lbs. of air
Hydrogen ..$1 + 3\frac{1}{2} \times 8 = 36$ lbs. of air

That is the smallest quantity of air required to effect perfect combustion, but in practice considerably more air is supplied. There is no violent action of an explosive nature when the process of combustion is going on in a furnace because the gases pass freely away. The intimate mixture of similar gases within a cylinder provides the power that drives a gas engine. The gas is the combustible and the air along with the gas forms the working medium.

Many philosophers familiar with chemistry and other of nature's laws perceived many years ago the possibility of using explosive proportions of gas and air to produce economical motive power; but for a long time the gas engine was nothing better than an amusing toy which presented an object of curious speculation for people with scientific tendencies. Even after inventors and engineers began to have practical ideas as to how a gas engine ought to be made, its development was very slow. The early experimenters naturally took the steam engine as a model and labored to design a gas engine that would give an impulse at every stroke of the piston. This was impracticable, but it was a rock upon which much earnest endeavor was wrecked.

In the year 1862, which I have referred to as the beginning of an epoch favorable to the construction of successful gas engines, M. Beau de Rochas, a French engineer, writing on the requirements of a gas engine, made the following propositions, which he held were essential in designing a gas engine:

(1) The largest cylinder capacity with the smallest circumferential surface.

(2) Maximum speed of piston.

(3) Greatest possible expansion of gases.

(4) Highest pressure at the beginning of the stroke.

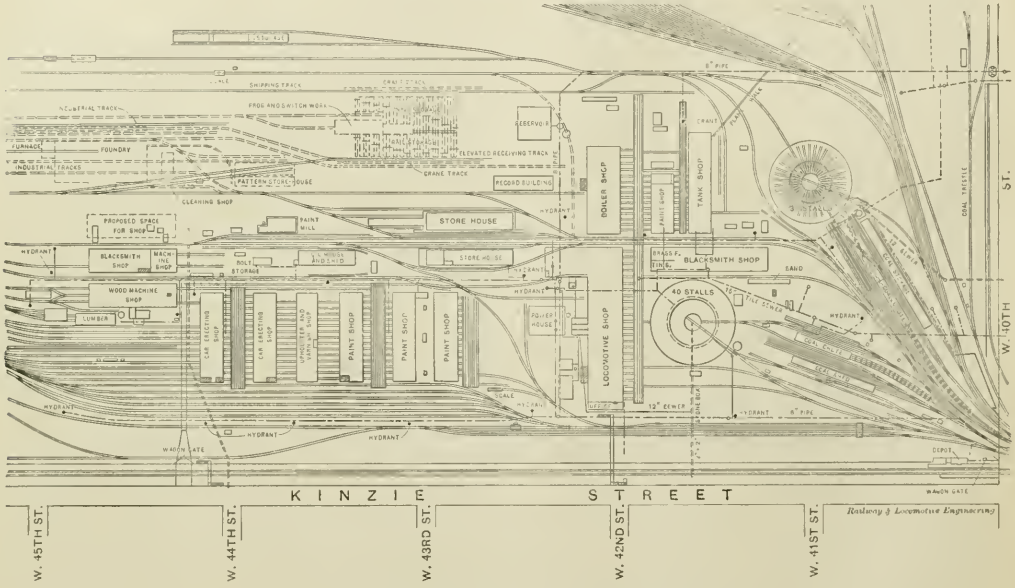
De Rochas afterwards embodied these requirements in a patent, which is popularly known as the Otto cycle, because Dr. N. A. Otto, of Germany, was the first to build gas engines on the de Rochas principle. There is no record of de Rochas ever having built a gas engine, but it is to be presumed that Otto had authority to work under de Rocnas' patent.

Otto and another German, named Langen, had worked together on the building of gas engines before de Rochas made his famous propositions. They labored to perfect an engine that produced an impulse from the gas explosion at every revolution of the crank. The great difficulty then experienced with gas engines was the suddenness of the explosion, which had a destructive effect upon the piston's connections. This trouble was to some extent overcome in an engine built by Otto and Langen, in which the expansion took place under a free piston whose velocity was not limited by the motion of the crank, and engaging the piston rod with the driving shaft only on its downward stroke. The engine was very ingenious and was an improvement on anything previously used; but it was rather complex and was subject to annoying failures. While Otto was struggling to make this engine a success, M. de Rochas patented the four cycle gas engine. Otto did not immediately cease his efforts to produce a gas engine designed after the ideas he had conceived, long before de Rochas expressed his views, which seemed almost prophetic, on the requirements of a gas engine. After experiencing a great many expensive failures, Otto adopted the Frenchman's ideas and began building gas engines according to de Rochas' patents.

The first engine built by Otto according to de Rochas' principle was brought out in 1876. Although the engine was not at first a howling success, it was far superior to anything in that line previously produced, and its operation led the way to improvements which have made the gas engine a winning rival of the best steam engines for many purposes.

Owing to his success as a builder of gas engines the cycle of operations on which the engine works came to be called the "Otto cycle," although he had no more share in inventing it than Stephenson had in the invention of the shifting link motion which bears his name. I notice that American engineers and others are falling into the habit of speaking of the de Rochas cycle, but the same people persist in calling the link motion invented by Howe, the Stephenson motion.

In the practical working of all Otto gas engines, and in nearly all other successful ones, four operations a.e performed in completing the cycle. In the Westinghouse gas engines, which are celebrated for their great size and efficiency, a trunk piston is employed along with other highly perfected mechanism for regulating the events of the cycle. At the commencement of the operation the piston is at the beginning of the stroke ready to move towards the crank. During this movement the piston acts as a pump plunger and draws the charge of gas and air into the cylinder. On the return stroke the piston compresses the charge of gas and air until it reaches the end of the stroke and is ready to return again. Then the gas is ignited by an electric spark, the charge explodes and drives the piston to the end of the



WEST CHICAGO SHOPS OF CHICAGO & NORTHWESTERN.

stroke. During the next stroke the piston expels the dead gas out of the cylinder and is again ready to perform the same cycle of operations. It will be understood from this description that in the four-cycle engine, two revolutions of the crank are made for each impulse transmitted from the explosion of gas in the cylinder.

It is not my purpose to enter into details about the mechanism employed to regulate the events of the stroke or to describe the methods used for cooling the cylinder. All these particulars can be obtained from one of the numerous hand books on gas engines.

There are a variety of gas engines in use besides that actuated on the Otto cycle, but none of them a e so reliable, although claims are made that several of them are more economical in the use of gas. This is a case, however, where reliability is of much greater importance, within ordinary limits, than economy of fuel. There is also another four-cycle gas engine besides that arranged on the de Rochas plan, but it is considerably more complex and is therefore more given to failures.

As will be understood from what has been written, the essential difference between the gas engine and other forms of heat engines is that the pr ssure which drives the gas engine and is partly converted into mechanical work, is produced inside the working cylinder of the engine. A few gas engines have separate vessels where the gas is exploded, but they are so few that they are not worthy of consideration. When fired inside the working cylinder the kinetic energy of the explosion is produced at the moment it is needed and no storage of heat is necessary.

The modern gas engine is the product of long development, similar to that undergone by the steam engine and other prime movers. It is by no means perfect, but the improvements effected upon it in twenty years have been wonderful. Writing in 1883, Prof. Silvanus P. Thompson said that it was impracticable to use gas engines for driving electric machinery, yet in this year of grace 1902 there are hundreds of gas engines driving dynamos successfully and there are hundreds of factories in Europe and America following the business of building gas engines. There is no industry requiring power that the friends of gas engines are not regarding as promising fields for the use of their motors. Since the gas engine became recognized as the most economical of heat motors an immense number of patents have been secured for gas engine appliances; but most of them have failed to perform the purpose for which they were invented.

The principal fuels used in gas engines are the various kinds of hydro-carbon gas, gasoline, kerosene and other oils that can be easily vaporized. Nearly all kinds of material that may be used as fuel in grates or furnaces can be converted in a gas converter into gas suitable for producing power in a gas engine.

There are a variety of appliances used for igniting the charge in a gas engine. The earlier methods followed were by means of a flame jet which was operated by mechanism which regulated the contact with the gas. The next arrangement brought the gas at the proper time in contact with a surface which is kept at a temperature above the igniting point. There are various arrangements of this character, but the most common one is known as the hot tube igniter. In some gas engines the compression of the gas is carried to a pressure which generates heat sufficient to ignite the charge The most common igniter, however, is an electric spark, which appears to be the most reliable, and for that reason is gradually displacing all others. A very important feature about an electric igniter is that its operation can be easily regulated to fire the charge with certainty at the right moment. The igniter is by some people regarded as a minor detail of a gas engine; but those who have wrestled with other igniters, trying in vain to find out why they do not work at critical periods, readily appreciate the merits of a good electric igniter which seldom fails and is easily put right when anything goes wrong.

When gas engines have been recommended to power users as a simple form of motor that was free from the dangers attending the use of a steam engine, with its boiler that was always threatening to explode or burn when cheap attendance was employed, they frequently concluded that any cheap and ignorant labor could safely be used to take charge of a gas engine plant. Cheap labor is nearly always the dearest in the end where knowledge, skill or care have money value; and they certainly have that in the man employed to care for a gas engine. There are more details to be attended to in keeping a gas engine working successfully than there are with the ordinary run of steam engines, and failure to keep every detail in good order reduces the efficiency of the engine and frequently results in failure. Most of the troubles that cause unexpected stoppages of gas engines are due to the man in charge being incompetent. The best advice that can be giv n to owners of gas engines is, keep an engineer in charge who understands his business.

West Chicago Shop of the Chicago and North Western Railroad.

BY R. T. SHEA.

POWER STATION.

The power station is a model of neatness, as is the plant in general. One of the main things that impress one on entering the North Western's grounds is the neat, tidy appearance of everything around the plant. The power station is situated in a little park, and on entering you are at once impressed with the surroundings. They have two 500 horse-power direct-connected Ball engines and the General Electric Company's generators; these furnish power for the entire plant. They have a 65 horse-power emergency generator that they can cut in when occasion requires. They have a Riedler air compressor, built by the Fraser & Chalmers Company, of Chicago, with a capacity of 1,500 cubic feet of free air per minute. There is a large overhead crane, large enough to lift any of the machinery or parts in case of repairs or breakdowns, which is a very useful feature.

PLANING MILL AND REPAIR YARDS.

The boilers are fed with the Rooney stoker. The arrangement for handling fuel is very complete. Fine nut coal is loaded into hopper bottom cars and switched over a pit on the outside of the power-house and the coal is dropped into this pit from the cars and lifted with conveying machinery to an overhead storage bin, from which it is fed by gravity into

the stokers. In the front of the boilers there is a little iron car run on a railroad track, level with the cement floor, and the ashes from the boilers are scraped into this iron car and run on the outside of the building and loaded into cinder cars.

Manual labor of attending these boilers is practically done away with, everything being done with machinery, and two men are all that are required to do the work. They keep a log in the power-house, and the revolution of every machine is kept track of, with indicators fastened to them, and a correct record of power produced and the cost are at once manifest.

Just outside the power station is a building for a toilet and wash room, to serve the men in the machine shop, which is a very neat affair and does away with having clothes lockers scattered all around the plant. In this building a locker is provided for each man, and hot water, cold water and porcelain wash basins to wash in.

MACHINE SHOP.

The main building, used as a machine shop, is divided in the center by a track running from one end to the other, and on this track they have a portable electric crane that serves the machines as well as the erecting shop. The machine shop is run with three electric motors (on the group system) of 35 horse-power each. One feature that appeals to a railroad man is the large number of wheel lathes, six being in use. A great many shops are delayed on account of not being able to turn wheels fast enough, and this seems to have been looked after in the Chicago & North Western's shops.

There is an annex to this machine shop, consisting of a large room, well lighted, with a balcony running all around it. On one side of this balcony are kept all the brass parts, brass lathes, and all the brass work, both machine and vise, is done in the balcony. On one end the air-pump work is done, and on the opposite side all the machine air-pump work and the Jones & Lamson turret lathes are located. A large elevator running from the floor to the balcony facilitates handling heavy parts. They have given a great deal of attention to special labor-saving tools in the brass-working department, and many of these are quite ignenious and are well worth investigating. In one end of the balcony there is a little room built off, in which are located lockers, toilet rooms and wash basins for the men.

ERECTING SHOP.

This has twenty pits, the engines being handled with an overhead crane, and the wheels are removed and replaced in the boiler shop. The machine shop is so designed that they could not have a heavy crane in it. They also have three overhead cranes in the erecting shop, of 20-ton capacity, for handling engines and parts of engines. They turn out about one engine per day in the erecting shop. The shop is roomy, well lighted and a very desirable place to work.

BOILER SHOP.

The boiler shop can justly be classed one of the leaders of locomotive boiler shops in the country, and is a very large, well-lighted building. It is served with a large electric crane, run at a high rate of speed and capable of handling the largest engines. The riveting plant is hydraulic and of the latest design, being capable of turning out new boilers on short notice. They also make use of the hydraulic power to run punches and other machinery. They have two large multiple drill presses, power rolls, and all other machinery usually found in a first-class boiler shop. Instead of annealing boiler sheets out of doors after flanging, as is the customary practice, they have a large oil furnace situated at one side of the shop for annealing these sheets, which is a very neat affair. The flue plant is situated in one end of this building, and an oil furnace is used for welding the flues.

1. POWER STATION. 2. ANNEX TO MACHINE SHOP.
3. ERECTING SHOP. 4. BOILER SHOP.

They have an ingenious flue rattler that will hold a complete set of flues at one rattling. It is run in water below the floor and discharges a set of flues itself, without any labor, on to a car, instead of having them incased in a cylinder, as is usually the case. There is an S-shaped arm that holds half of the flues on each side of the journal and is entirely covered with water. While this flue rattler is situated in the boiler shop proper, there is absolutely no noise to it. It would well repay anyone contemplating putting in a flue rattler to see this machine.

Another very good practice is their way of putting on crown bars on light engines using them. They are riveted to the crown sheet instead of being fastened with bolts. Both the front and back head are left out of the firebox, and these crown bars are riveted on before the firebox is put in the boiler. The object in leaving the front and back heads out until the crown bars are riveted on is so that the men can drive the rivets. It will readily be seen that by putting the bars on in this way there is quite a good deal of time saved.

TANK SHOP.

The tank shop is situated in another building, across the tracks from the boiler shop, and is a very complete shop. This is served by a 60-ton electric traveling crane, and the shop is fitted with shears, punches, rolls and all other appliances for doing tank work. The machinery in the tank shop is run with direct-connected electric motors. They have a multiple-power punch for punching tank sheets, that punches six holes at once, with a power feed.

In one end of this tank shop is situated the wheel plant, where they have one double-head and one single-head axle lathe, a wheel-boring mill, a hydraulic press and suitable crane arrangements for handling the work very quickly. This shop is run with a 20 horse-power electric motor.

CAR DEPARTMENT.

The car department is one that has been given a good deal of study. It is divided up into a number of buildings. The paint shop is in two buildings, each one holding about fifteen cars; then come the coach tin shop, upholster shop—which is located in another building—and to the west is located the coach shops, each holding about fifteen cars. In one end of one of the coach shops is located the coach truck shop, which is served with overhead air hoists and all the facilities for doing this class of work very rapidly and cheaply.

In each one of the coach paint shops between all the tracks they have permanent adjustable scaffolds that take up very little room and save carrying trestles and boards around.

Between the shops is an electric transfer table, and instead of having the trolley wires suspended overhead, they have them in conduits underneath the ground. This does away with wires breaking and accidents resulting therefrom. It is entirely practical and seems to be a good idea.

West of the coach shop is a building of the same size and construction as the coach shops, used as a way-car shop. In this they have fifteen cars, and do all their way-car work and way-car truck work.

West of this is the wood-working mill which is a very complete plant, and one is at once impressed with the care used in locating it. The drying house and lumber sheds are located on the south end of this mill, and the lumber and material are fed into it by two continuous tracks from the west end, and delivered at the east end, finished and ready for the cars. This building is a two-story affair, and in the second story is located all the light machinery for doing the light coach work. Attached to the wood-working mill is the power-house for this department, and the shavings and refuse lumber are fed into the boilers without any handling to speak of.

The car machine shop is located just across the tracks from the wood-working mill. In this all the wheel work for the car shops is done and all the bolt work and everything in metal that pertains to car work.

PAINT SHOP.

A little farther east is a fine building, where all the paints are manufactured for the entire North Western road. Visiting this department would consume profit-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5. ANOTHER VIEW OF BOILER SHOP.
7. CAR DEPARTMENT.
6. TANK AND BLACKSMITH SHOP
8. FREIGHT AND PLANING MILL.

ably an entire day of one's time. The ore used in making the mineral paints is delivered here from the Northern territory, crushed, ground and finished throughout, ready to apply to the cars. The ore is crushed and ground and then carried to the second story of the building by suction, and there divided into three parts—the heavier or coarser mineral b ing deposited in the first room, the second grade floating over into the second room and the third or superior grade is carried by a very mild current of air into the third room. The third grade is as fine as it is possible to produce it, and is used for very fine work. The first grade, or the ordinary mineral, is used on box-car work.

This building is devoted exclusively to making mineral paint, and the laboratory department is entitled to a good deal of credit for the study and care they have given to the manufacture of this paint.

In another building they grind all the other paints used on the system, both for passenger cars and buildings. They buy the pigments in large quantities when opportunity offers and grind and mix as it is needed for service.

They have a regular atalogue, giving the colors and numbers of the paints, which is sent to every point on the system, and the paint is ordered from the catalogue.

When it is ground and put in cans it is put in the second story of the oil house, a little distance from the factory. It seems as though this was quite an important matter for railroads to consider, as it insures giving them a quality of paint they desire and absolute uniformity at a minimum cost.

REPAIR YARDS.

Leaving the wood-working mill, one at once steps into the freight car repair yards. They have fifteen repair tracks and about every five tracks they are served with a supply or material track. At the center and at one end of these repair tracks they have cross tracks with suitable turntable, so that it is no trouble to reach any car with a rubble car loaded with material. The material used on the repair tracks is stored and marked in a suitable building, fitted with racks, in a convenient location, so that it is no trouble for the men to get what they want in the way of material. These tracks are bordered by a very nice park, and everything that could be desired for the cheap and rapid repair of freight cars seems to be here.

We are indebted to the foremen of the different departments, as well as to the superintendent of motive power for the courtesies extended, as they seem to be always ready and willing to show anyone interested the advantages of the North Western shops.

The Brady Brass Company intimate that they have changed their New York office to 95 Liberty street. Telephone number, 2240 Cortlandt.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(91) W. B. T., Savannah, Ga., writes:

Will you please tell me, if possible, how many drops there are in one pint of valve oil? A.—About 6,600 drops is the number run through one of the best known lubricators. We wish that our readers would take a note of this answer, because the question comes in about once a month.

(92) W. H. B., Columbus, Ohio, writes:

Will you please explain in Questions and Answers how to tell a right-lead engine from a left-lead engine, and why they are put up differently in regard to right and left lead? I have heard much talk on this point at the Lodge room, so please explain. A.—If you put the engine so that the right-hand crank is on the forward center, and you find that the left-hand crank is on the top quarter, that is a right-hand lead engine. If the left-hand crank is on the lower quarter when the right-hand crank is on the forward center, that engine's left crank leads. There is no difference which crank leads.

(93) B. J. E., Fort Wayne, Ind., writes:

Which do you think is the better way to double-head trains—to have both engines coupled together on the head end, or to have the second engine five or six cars back in the train? A.—Each method has its preferences and advantages. The former brings the engine crews in closer communication, which some persons believe brings better results. The second method is practiced on roads which object to bringing the combined weights of two engines in such a short space on bridges and trestles; hence the separating of the engines. This method is also believed to be less severe on couplers and draft gear.

(94) W. F. G. writes:

I stretched a line from points two rail lengths (60 feet) apart and found distance in center, between line and rails, to be 44 inches. What is the degree of curve? A.—The best way is to work this out so that it will answer other similar questions. We first find the radius of curve as follows: Square the distance between line and rail (in feet) and add half the length of line used. This gives 16.6 feet plus 30 feet squared, or 916.6 feet. Divide this by twice the distance between line and rail, or 8.16 feet. This gives 916.6 divided by 8.16 feet, or 112.3 feet radius of curve. To find degrees, divide 5,730 by the radius, because one degree of curvature is equal to a radius of 5,730 feet; and while this does not hold exactly true on small curves, it is quite close enough for our purpose in this case. Dividing 5,730 by 112.3 gives about a 50-degree curve, which is excessive and only used on logging roads.

(95) J. A. S., Creston, Iowa, writes:

In question No. 52 of Sinclair's questions and answers, it is inferred that when the main rod is taken down, and the piston pushed to its extreme stroke, either forward or back where it will strike the cylinder head, the packing ring will get into the counterbore of the cylinder and hold the piston fast. The question and answer go on further and tell how to avoid this trouble in disconnecting. Now, all the engines I have ever seen have the counterbore just deep enough that when the piston strikes the cylinder head, the packing ring overhangs the counterbore, but can't get into it. At full working stroke the ring overlaps the counterbore just sufficient to prevent a shoulder wearing at the end of the stroke. I would like to ask what build of engine allows the packing ring to fall into the counter bore when the cylinder heads are in place A.—Modern-built engines will not permit this; but the question and answer were formulated to take in the obsolete types of engines of not so very many years ago which did permit it.

(96) A. A. F., Osawatomie, Kan., writes:

Can an engine be properly lubricated with the throttle wide open as well as with throttle being worked in proportion to travel of the valves? I claim the throttle as well as the stroking of the valves should be governed by the amount of power required to pull the train. My friend claims it is best to work a wide-open throttle at all times and control the admission of steam to cylinders by the reverse levers. I say the less the throttle the easier to lubricate the cylinders. So please advise me of your opinion of who is right, and what book you can furnish me with treating on such subjects. A.—The valves can be oiled more easily when the engine is worked partly closed than with it wide open, but running with the throttle partly closed is not considered good engineering. This correspondent requested a private answer to be sent which was done reluctantly. We receive a great many letters from readers of the paper requesting private replies to be sent to questions which the writers wish to have answered. While we desire to be as accommodating as possible to our friends, we wish it to be understood that our purpose in publishing a question and answer department is to give information that will interest the mass of our readers. We frequently received questions sent to be answered in the paper which are merely of local or personal interest. These we do not consider suitable for answer in our question and answer department, and people sending them need not be surprised to find that the questions are not answered.

The shopmen of the Philadelphia & Reading Railroad call what in other parts of the country is termed a flue rattler, a churning machine.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Manhattan Air-Brake Club.

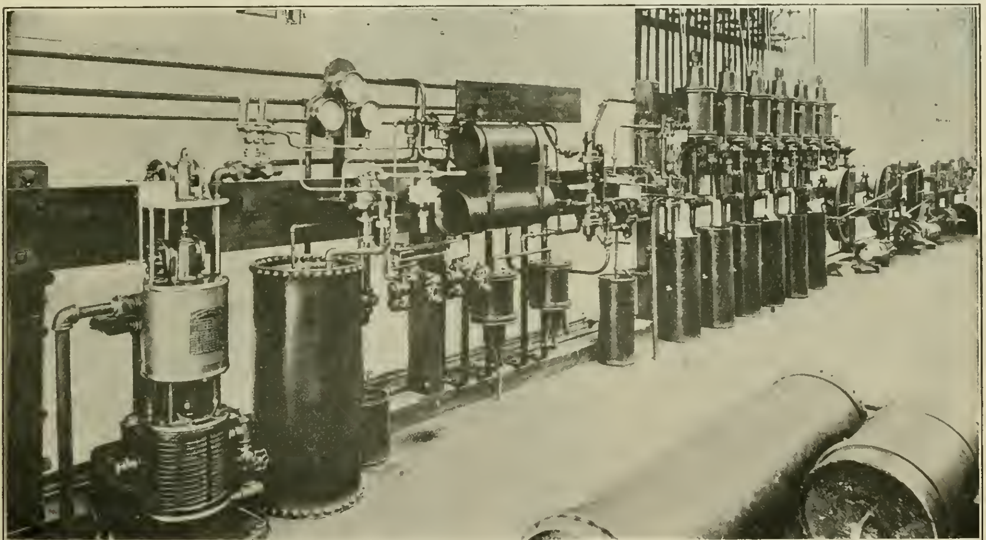
A meeting of the air-brake inspectors of the several railroads entering and around New York city was held on December 12th, and resulted in the organization of the Manhattan Air-Brake Club. The object of the club is to promote a better acquaintance among the air-brake inspectors of New York city and adjacent lines, and to pool the air-brake practices and experiences on these several lines. The subjects discussed by the club will be those on air brakes which are most alive to railroad interests at current times, thereby giving all of the roads represented the quick and immediate benefit of the combined experience of all the others. In this way the club will be of practical value and real assistance to the railroads, and will act as a feeder to the Air-Brake Association in a similar manner that the railroad clubs, Traveling Engineers' Association and Air-Brake Association do to the Master Car Builders' and Master Mechanics' Associations.

The following officers were elected: President, T. L. Burton, Central Railroad of New Jersey; vice-president, H. C. Oviatt, New Haven Railroad; secretary and treasurer, W. P. Garrabrant, Pennsylvania Railroad. Others present were W. C. Carr, Ontario & Western Railroad; O. E. Moore, Erie Railroad; P. J. Langan, Lackawanna Railroad; John Roney, Lehigh Valley Railroad; E. G. Desoe, Boston & Albany Railroad; W. F. Gross, RAILWAY AND LOCOMOTIVE ENGINEERING; S. D. Hutchins, Westinghouse Air-Brake Company, and F. M. Nellis, Westinghouse Air-Brake Company.

Slid-Flat Wheels.

As regular as the seasons, as periodic as the tides, as dreaded as a malignant disease, and as sure as death and taxes, is the season of slid-flat wheels. That season, with its letters of inquiry and complaint from the superior's office, is now upon us. Those roads which are fortunate possessors of an efficient general air-brake inspector will find the number of "slid-flats" materially reduced over last year's crop; for that shrewd ubordinate will have anticipated the trouble, sought out the causes and applied the remedies, so far as was within his power. Roads having no general air-brake inspector will probably have no diminution in their crop of "slid-flats"; and, if anything, an increase may have been had instead.

The rather sudden change from the good, clean rails of the summer months to the greasy, snowy and icy rails of the late fall and early winter seems to offer irresistible inducements to the chorded disk. This period might be appropriately calendared on the railroad almanac as the "Flat-Wheel Season," and fittingly symbolized by a picture of a car wheel with a chordal section of the tread removed. Should further emphasis be necessary to attract due attention to the close and dangerous approach of the "Flat-Wheel Season" and its expensive annoyance, such emphasis might be added by painting on the symbol wheel of the calendar, in prominent numerals, the dollars' value represented by the ruining of a pair of slid-flat wheels.



A FAMILIAR EXHIBIT AT THE PAN-AMERICAN EXPOSITION, BUFFALO, N. Y.

The High-Speed Brake.

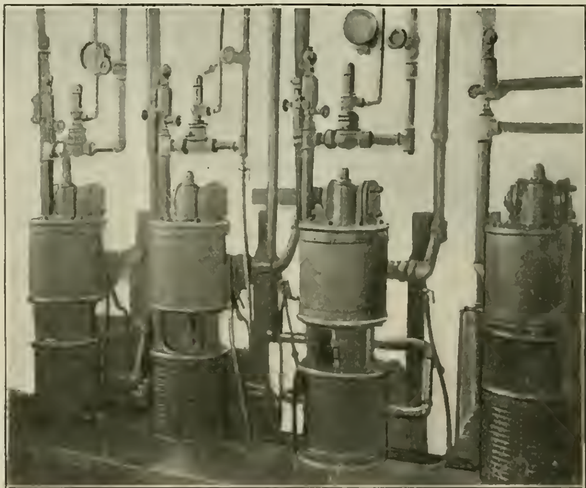
It is now about eight years since the high-speed brake was introduced in practical actual railroad service. Almost immediately upon its introduction it passed quickly from the experimental stage into what might be properly termed the preliminary practical stage. Here it has lingered, with a successful and satisfactory performance, to the present time. Somehow, and perhaps somewhat unfortunately, the name has seemed to limit thus far the application of the high-speed brake to such trains as maintain a high continuous speed, and make no stops, for a large number of miles between two terminals. Trains of this kind, and upon which the high-speed brake has been installed, are the "Empire State Express" of the New York Central, the "Congressional Limited" of the Pennsylvania, and other similar trains. These trains are of a class which might be popu-

larly termed "express," "limited" and "flyer." Thus far no substantial recognition has been taken of the fact that perhaps some of the most serviceable and advantageous trains upon which the high-speed brake could be placed are the fast suburban trains, which make many stops, frequently attain high bursts of speed, and average a comparatively low rate of speed. There is no question but that the swiftly moving suburban train, with the lesser rights of road and privileges, and being obliged, as it were, to dodge in and out and feel its way along instead of having the road cleared for it, as has the limited, express and flyer, should also have the high-speed brake. A bicycle rider, racing on a track patrolled and kept clear for him, might possibly find a brake which would stop him quickly in case of a perilous emergency, a very valuable possession; but another rider on a crowded thoroughfare, making fast time, and nervously dodging opposing vehicles and others coming from side streets, would doubtless find even greater use for a good brake on his machine and would probably find more frequent use for it than the racer on a clearly patrolled track. We believe the cases of these riders are analogous to those of the express train and the accommodation or local train.

ONE OF THE ITEMS OF EXPENSE ON A RAILROAD.

The increase of speed from the express train running 40 miles an hour twenty years ago to the express train to-day, maintaining an average speed of 60 miles per hour, has caused the expenditure of many thousands of dollars. This increase in speed has been but 30 per cent. The high-speed brake which increases the efficiency of the brake as a stopping device, or reduces the length of stop 30 per cent., costs only about $25 per car. It is not just clear why the railroads have sought the increased speed, yet made no provision to increase the efficiency of their brakes or to proportionately decrease the length of the stop. Possibly they believe that the standard quick-action type of brake is sufficient and will meet all ordinary contingencies of service. While this belief may be partly logical and true, still it is hardly justifiable; and it should be remembered that emergencies may arise, which, unless they are properly met, may result in accidents aggregating thousands of dollars—many times more than the cost of equipping with the best possible brake devices. The proverbial Texan cowboy carries the best obtainable firearms for his self-defense in emergencies he may possibly meet. Should anyone attempt to convince this individual that a mediocre firearm would be sufficient for his ordinary use, and that important emergencies would seldom, if ever, arise, he would be spurned by him as a person of suspicious intelligence. He would probably reply that a cowboy seldom needs firearms, except in very remote, though exceedingly trying exigencies; and then he needs the best weapon obtainable.

The record of the high-speed brake in its work thus far on railroad trains has been of a very flattering and complimentary nature, and proper investigation would prove a justification in applying it to all passenger equipment cars. Not only has it proved itself a superior stopping device of increased efficiency, cutting off the last 30 per cent. of the stopping distance, in which the damage is always done, but it has given a remarkable record of freedom from flat wheels. However, overzealous champions of the high-speed brake should not be too sanguine and so unguarded when lauding the virtues of the high-speed brake as to unthinkingly guarantee immunity from slid-flat wheels. Flat wheels have been known quantities on cars ever since brakes were first designed, up to the present time; but there is no doubt that the high-speed brake will largely reduce the number of slid flats. Especially is this true of roads which have long, damp tunnels, dripping bridges or aqueducts which furnish slippery, greasy rails, where wheels, once beginning to slide, will not cease after they have left the greasy track and passed on to a dry, clean rail. Express train service requires very few stops and fewer harsh ones than do the quick, energetic suburban and local trains. Hence it will be but reasonable to expect a few flat wheels, even on a train equipped with high-speed brakes, in this class of service.



BATTERY OF AIR PUMPS IN PHILADELPHIA TESTING YARD OF THE READING RAILROAD.

The New Westinghouse Air-Brake Instruction Book.

The Westinghouse Air-Brake Company's revised Instruction Book has just come, fresh from the press. This book, while retaining all of the old descriptive parts, and much additional, also contains much new material on the subject of maintaining and handling air brakes not appearing in the old issues. Perhaps one of the most valuable additions to this book, which makes it a marked improvement over its predecessor, is the chapter on leverage, which covers several pages, being very full and complete. This chapter will be especially relished and found invaluable by drawing-room men and others who have to do with the designing and preparation of levers for foundation air-brake gear. As usual, the book will be supplied to railroad employés, on orders coming from the heads of departments, such as the superintendent of motive power and master car builder.

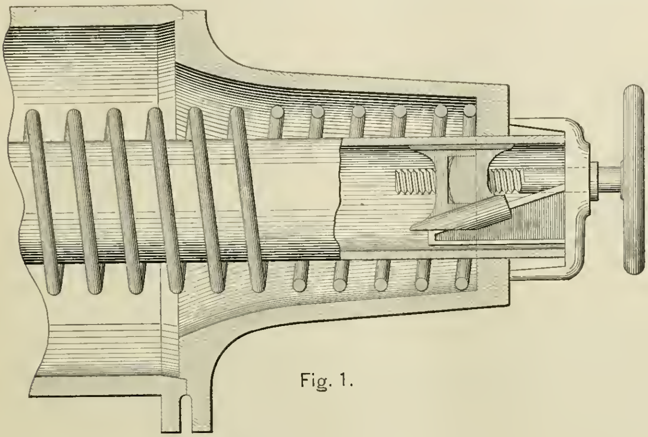


Fig. 1.

DEVICE FOR HOLDING PARTS INTACT WHILE CLEANING. SCREW DRAWS NUT UP INCLINE, FORCING OUTWARD ON INNER SIDE OF PISTON SLEEVE.

CORRESPONDENCE.

The Air Pump.

The air pump of the brake system is called upon to feed a varying number of parasites which are more or less greedy. Sometimes it is difficult for it to perform its primary duty, much less care for these intruders.

When the air brake was first brought out, the old 6-inch pump was found to be capable of supplying all the air required by the brakes. Later, when the demand increased, the 8-inch pump was developed. Now, however, the long trains of air-braked cars have demanded a still larger volume of air, and the 9½-inch pump is struggling to do its duty in caring for them. If it had no other work to do than supply air for the brakes, it would be large enough, but as matters stand it seems to be a question of cutting down the demand for air or of providing some way to increase the supply. The amount of air consumed by the sanders, bell-ringer and other refinements is larger than one would at first suppose, and this additional demand causes the pump to work harder and longer than would otherwise be necessary. The result is a shorter life of the pumps, in addition to the constant danger of it running hot.

Several plans have been offered to assist the pump, one being the placing of an additional pump on the engine. While this seems to be a good plan, many do not favor it. Another plan that has been tried by some roads is to remove the jacket and lagging from the air cylinder and leave it entirely bare, or replace it with a perforated sheet-iron jacket, allowing the air to circulate around the cylinder and carry the heat away. The Westinghouse people go a step farther in this direction and send out a pump with a ribbed air cylinder. This is an even better arrangement than the other two, as the ribs present a large surface for the radiation of the heat produced by the compression of the air. A third plan has been proposed, but has not met with favor, although it is perhaps the best that could be devised, as far as the theoretical side is concerned. This plan is to jacket the cylinder with water to more rapidly carry away the heat. This means more or less complication, and that is a thing to be avoided, especially on a locomotive. However, it may be that it would work satisfactorily, and the gain realized might more than offset the disadvantages.

Some work of an experimental nature was undertaken by Mr. G. S. Goodwin, now with the Chicago, Milwaukee & St. Paul Railway, and the writer, to see how the conditions of operation of the brake pump could be improved. A new 9½-inch air pump was received from the manufacturer and fitted up for testing. The general arrangement of the apparatus was illustrated on page 498 of the November, 1899, number of RAILWAY AND LOCOMOTIVE ENGINEERING. These tests were made with constant conditions, except that several changes were made in the air cylinder. Arrangements were made for determining the temperature of the air before entering and after leaving the cylinder. The amount of air pumped was measured, as was also the steam used. A constant steam pressure of 90 pounds was employed, that being the highest that was continuously available. The air pressure was 75 pounds. The pump made about 100 strokes per minute. Each test lasted two hours. In order to compare the performance under the different conditions the air compressed was reduced to its volume at standard conditions per 100 strokes; that is, the volume of free air at a barometer pressure of 14.7 pounds and a temperature of 60 degrees Fahr.

The first test was made with air cylinder lagged and jacketed just as it was received from the makers.

In the second, the jacket and lagging were removed and the bare cylinder was permitted to radiate as much heat as possible. For the third test, the bare cylinder was cooled by a blast of air upon it, this being a condition similar to that obtained with such a pump upon a locomotive in motion. The last test was made with an improvised water jacket. This jacket extended around the front, from the admission to the discharge valves, and was made of sheet iron fastened to the flanges of the cylinder. The illustration before mentioned shows the pump as arranged for this test.

The results obtained from the four tests are given in the table. It will be noticed that the difference between the cylinder lagged and bare is not very great, the temperature after compression being but 16 degrees less and the air compressed but 6 feet more for the bare cylinder over the lagged one.

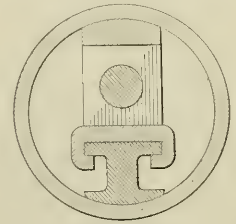


Fig. 2.

END VIEW OF PARTS INSIDE OF PISTON SLEEVE.

Test	Temp. entering air	Temp. discharge air	Temp. room	Cu. ft free air per hour
1	68	420	80	1,404
2	68	404	81	1,414
3	67	327	80	1,451
4	68	337	80	1,466

When, however, air was blown on the bare walls of the cylinder, the final temperature immediately dropped from 420 to 327, while the volume of free air increased from 1,404 to 1,451 cubic feet per hour.

The test with the water jacket is more favorable as far as the volume of air is concerned, but the delivery temperature is some 10 degrees higher than in the third case.

The last two methods are especially favorable to good lubrication, and decrease the liability of the pump to run hot.

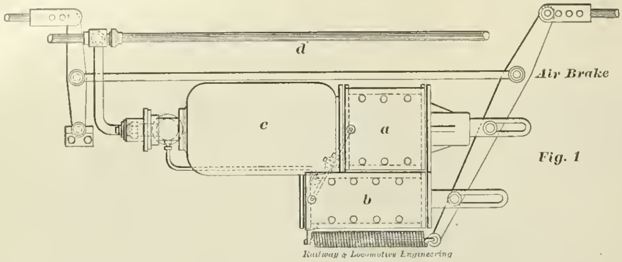
It seems from these tests that although the water jacket gives a somewhat greater capacity, yet the bare cylinder on the moving engine gives nearly equal results without the complications necessary with a water jacket. The ribbed cylinder furnished by the Westinghouse people, being much better adapted for heat dissipation, would, in all probability, give results equally as good, if not better than the water-jacketed cylinder.

A. B. Gould,
Instructor in Experimental Engineering.
Sibley College, Cornell University.
Ithaca, N. Y.

A Reinforced Brake.

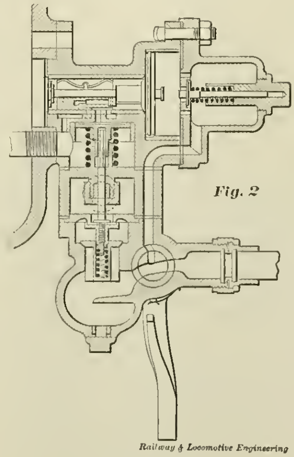
The accompanying sketches explain a device for reinforcing the ordinary brake power, as patented by August Bruggeman, of Breslau, Germany.

Fig. 1 shows the general arrangement of the device; *a* and *c* are the usual familiar form of brake cylinder and auxiliary reservoir; *b* is the supplementary or reinforcing brake cylinder. In ordinary service application of the brake, while the slide valve is in the graduating position, auxiliary pressure goes to the brake cylinder *a* as usual. However, after full service is obtained and the slide valve passes to full emergency position, the quick action feature of the triple is called into play and train-line pressure is vented to the supplementary cylinder *b*, thus giving auxiliary reservoir pressure in cylinder *a* and train-pipe pressure in cylinder *b*. In emergency applications, also, the auxiliary reservoir pressure and the train-line pressure go to cylinders *a* and *b* as above described, except that both cylinders get their pressures instantly and simultaneously.



A REINFORCED BRAKE.

Fig. 2 shows a modified form of the Westinghouse quick-action triple. The cut-out cock is arranged to cut out the brake completely or the supplementary cylinder only. The emergency parts are also modified so as to send the train-pipe pressure out of the side of the valve to the supplemental cylinder, as shown in Fig. 3. Both cylinders exhaust through the triple. Practically the same device was used in the United States ten years ago.



A REINFORCED BRAKE.

A Good Air Pump Record.

Engine No. 1720, on the New York Central Railroad, has been running between Buffalo and Dewitt, N. Y., equipped with a New York No. 2 air pump, which ran thirteen months, about eighteen hours out of twenty-four every day, excepting at times when the engine was held in for light repairs and being washed out.

There were no repairs done to the pump, except packing at intervals of about two to four weeks. The service on this line is what we consider rather severe on air pumps, as from sixty to ninety and as high as 100 cars are coupled in one train, and there was a great amount of leakage, which usually exists in trains of this length.

This engine was run by several different engineers, who are deserving of a great deal of credit for the manner in which the pump was run. A small amount of graphite was put in the air cylinders when the pump was new, and at no time was there more steam turned on the pump than was required to maintain main drum pressure, as well as being started slow, which prolongs the life of an air pump to a very great extent, especially on high-pressure engines of to-day.

The condition of this pump when overhauled was fairly good, excepting the packing rings to the air cylinders, and air valves were worn not to exceed ¼ inch lift.

Buffalo, N. Y. William Owens.

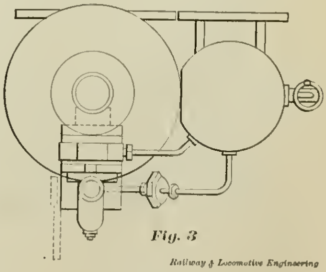
To Ease the Air Pump.

I have often thought a cut-out cock placed in the discharge pipe from our overworked air pumps would be an important factor that would aid in the pump's care. Pumps often appear O. K., until after the train line is charged, when signs of dryness appear. As air valves are seldom tight enough to oil a pump through the oil cock and often cause oil to be blown in one's face instead of going into cylinder, it appears to me that a cut-out cock would be the means of saving much time and air by making it easier to care for the pump, thereby prolonging its life and efficiency.

As this valve could not be the means of injury to the air-brake performance, I see no reason why it should not be used as an aid, especially on our long, important freight runs.

Chas. W. Clegg,
Engineer C. & N. W. R
Boone, Iowa.

A bright individual in Nashville has patented a method of connecting the head light with the truck so that it will turn with it on curves and cast its beaming rays around the corner. To do this he puts a vertical shaft down through the front end and connects with truck. The introduction of additional parts in the front end is not apt to be looked on with favor by railroad men.



A REINFORCED BRAKE.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(110) J. M. C., Jersey City, N.J., writes:

We are using Marvin's grease in our brake cylinders. Would this same grease be all right for triple valves? A.—Yes, if applied in very moderate and reasonable quantities much the same as though vaseline were used. Large quantities, however, should never be used, as that would cause the triple valve to get dirty quicker and might cause a little trouble.

(111) T. D. E., Huntington, W. Va., writes:

In putting up a new train pipe on a freight car, would you put a spliced nipple, say about 10 inches long, on the end of the pipe where it screws into the angle-cock? This lets the pipe in good shape for repairs if the angle-cock is knocked off and the pipe broken. A.—Some roads do it, and others do not. It is doubtless largely governed by opinion and local conditions.

(112) F. O. E., Pittsburgh, Pa., writes:

I see that the Air Brake Association recommends copper piping for the air gage. We are using iron pipe. Is this not just as good? A.—Copper pipe is better than iron, inasmuch as it is more pliable and does not cause a twisting action on the gage if the pipes do not happen to be perfectly fitted. With iron pipes, this twisting action is serious, inasmuch as it has a distorting influence on the inner mechanism of the gage, causing it to register improperly.

(113) J. M. C., Jersey City, N.J., writes:

We are using Marvin's grease. Some time ago we bought another kind which looked just like Marvin's, but it got hard and gummed up; was very sticky. Does brake-cylinder grease do this? A.—Brake-cylinder greases which have similar outward appearances very frequently happen to be made up of entirely different ingredients. It might prove a good practice to use only high-grade and well-recommended greases, steering clear of other kinds which are recommended to be just as good.

(114) J. J. C., Reading, Pa., writes:

I notice that the new triple valves sent us have a packing ring in the emergency piston. When we order extra pistons, solid pistons are sent us without any rings. Why is this? A.—The packing ring is used in the emergency pistons of the passenger triples only, and not in the F-36 freight triple. All new passenger triples sent out have this piston and ring; but extra parts, unless specified with the ring, do not have the packing ring. If desired, the piston should be ordered with the packing ring.

(115) M. R. E., Hartford, Conn., writes:

With the brake-valve handle in full release position, the red hand of the air gage stands 7 pounds higher than the black hand. In the running position, up to 70 pounds, these hands stand the same way. After that they separate and will stand apart as much as 20 or 25 pounds. Where should I look to get at the trouble? A.—The gage is most probably out, for the red and black hands should be exactly together in either full release and running position. After 70 pounds is reached in running position, the hands should properly separate as you describe. The gage needs testing and adjusting.

(116) O. P. J., Portsmouth, Va., writes:

Can brakes on a light engine apply in service without the equalizing piston rising all right, but the piston rise in service application when the engine is coupled to a train? This engine will set all right in the emergency on either the light engine or with a train. A.—Yes. If the leather gasket above the equalizing piston leaks, or the packing ring in the equalizing piston leaks badly, the piston will not rise on the light engine, but air can be drawn from the train pipe through the preliminary exhaust port, thus applying the brakes on the light engine. When the engine is coupled to a train, the volume of train-pipe air under the piston is so much greater than that on top that even with the bad gasket and leaking packing ring the equalizing piston will sometimes rise and the brakes set.

(117) M. R. E., Hartford, Conn., writes:

I have a rotary valve which I have tried to grind tight, but the more I grind it the worse it gets. The bearing is all right in the middle of the valve, but the outer edge of the valve and its seat stand apart. What material do you advise for grinding? A.—The proper way to seat a rotary valve is to face off the valve and the seat, either in the lathe or with a scraper, as neatly as possible. Just sufficient grinding should be done to work out the tool or scraper marks. Any further grinding will cause the outer edges to grind away faster, thus leaving the parts in the condition mentioned and described by you. If anything, the parts should be so scraped that the outer edges have a heavier bearing than the middle portion. Then a little grinding will bring them exactly to a fit. Trojan Compound or ground glass and oil are the best grinding ingredients we know of.

(118) M. E. L., Port Jervis, N. Y., writes:

Is a heavy grease better than oil for brake cylinders? What do you think of a mixture of half grease and half black oil for brake cylinders? A.—If the grease is of a high grade and the right proportion, it will give results superior to oil in brake cylinders. If it is not, and contains large proportions of base ingredients and little lubricant, and will roll up into gummy pieces, this so-called grease lubricant is far inferior to oil. Marvin's grease is a high-grade brake cylinder lubricant, and has given highly satisfactory results in every instance on the many railroads where it has been used. A recent experiment made by the Westinghouse Air Brake Company proved that a mixture of high-grade grease and oil did not give as good results as the grease alone. A poor grade of grease would probably be benefited by oil being added to it.

(119) B. B. E., Chattanooga, Tenn writes:

In last number you give the strokes of the new 11-inch and the 9½-inch pumps but not the 8-inch. Does the stroke stay the same at all times? A.—The stroke (maximum) of the 8-inch pump is 9 inches. The stroke of the air pump varies in length in accordance with the pressure and speed. When the speed is high and the pressure low, the maximum stroke is had, because the inertia of the piston parts carries them a little farther, even after steam has begun to be admitted to reverse the pump, and the wide opening of the port by the reversing valve results. At low speeds and high pressure, the minimum length of stroke is had, as a partial opening of the port to the reversing piston will then admit sufficient pressure to produce a reversal of the pump, and the high air pressure more effectually checks the inertia of the piston parts.

Traveling Engineers' 1901 Proceedings

We have just received the "Proceedings" of the 1901 convention of the Traveling Engineers' Association, held in Philadelphia last September. As usual these "Proceedings" contain interesting and valuable information which characterizes the proceedings of this association. This book is nicely gotten out and can be obtained from this office or from the secretary, W. O. Thompson, Box 152, Elkhart, Ind. The price is 75 cents for paper bound and $1.00 for leather bound copies.

Examination Questions and Answers on the Air Brake.

This excellent book, so complete with air-brake information, is meeting with an unexpected sale. Although low in price, being but 25 cents per copy, the volume of books sold permits this low price to be maintained. The book is replete with all kinds of air-brake information, being full on both the Westinghouse and New York equipment, giving the constructions, operations, disorders, symptoms and cures of both systems. It also treats fully on that part of the work characterized as road work. The book is doubtless the most complete and valuable of its kind for all men who have to do in any way with air-brake work, being equally good for engineers and other road men, or the machinist in the shop and the car inspector in the yard. The book was adopted by the Air-Brake Association, and has the unique feature of having nearly 700 authors. It contains nearly 1,000 questions and their answers and 100 illustrations. Send 25 cents for a copy.

Readville Shops, New York, New Haven & Hartford Railroad.

These are quite large and commodious, being about 150 x 200 feet. As will be seen, the plan shows both a blacksmith and machine shop. The steam hammers range from one to four thousand pounds and are served by air hoists on the curved track shown. The large hammer is also served by the two swinging cranes which handle material to both the furnaces and stationary blast forges.

Both the blast and exhaust pipes for the forges (which are of the Buffalo type) are carried beneath the floor, as indicated, leaving a clear space upon the floors for handling material with the overhead cranes. The air hoists on the runway shown are supplied by air hose at different points instead of attempting a continuous supply. The bolt department is at the end of the blacksmith's shop and consists of four machines, as shown. These are served by oil-heated furnaces. The shops are electrically driven, with the exception of the steam hammers and air hoists, some of the tools being grouped and the others driven by line shafts.

The power houses contain three batteries of water-tube boilers, each battery consisting of 200 horse-power units. Three engines drive direct-connected dynamos generating current for the shops. In the truck shop there are two electric cranes of 25,000 pounds capacity, one over each track. The shops are not yet in operation, nor are they likely to be for some little time, but they promise to be the most modern in New England, and the general arrangement of tools, as well as the selection of these tools, will be of value to anyone who has new shops in contemplation.

The Colored Supplement.

This issue contains a colored insert of the latest type of passenger engine now generally in service in this country. The engine shown is one of the last lot built by the Schenectady works of the American Locomotive Company for the New York Central & Hudson River Railroad, one of them pulling the famous Empire State Express, to which another car has been added, making it a five-car train.

The modern locomotive does not present much of a field for color work, but the result, which is a combination of the photographic skill of Mr. F. W. Blauvelt and that of the engravers is very creditable and will, we are sure, be appreciated.

The flues, 19 feet long, which were used in the Prairie express engines of the Lake Shore & Michigan Southern were regarded as a doubtful experiment by many railroad men, and even locomotive builders feared that it was carrying a good thing too far. Service, the inexorable searcher into engineering fallacies, says that a flue 19 feet long is all right when used in a short, wide firebox. The Prairie engines referred to have done extraordinarily heavy work, but they have had no trouble with leaky tubes and they are fine steamers.

Examination for Promotion.

CONTINUATION OF TRAVELING ENGINEERS' QUESTIONS AND ANSWERS FROM PAGE 499, NOVEMBER ISSUE.

Q. 104—Will it sometimes work better if steam-throttle on boiler is shut off, so as to supply only steam enough to work the injector?

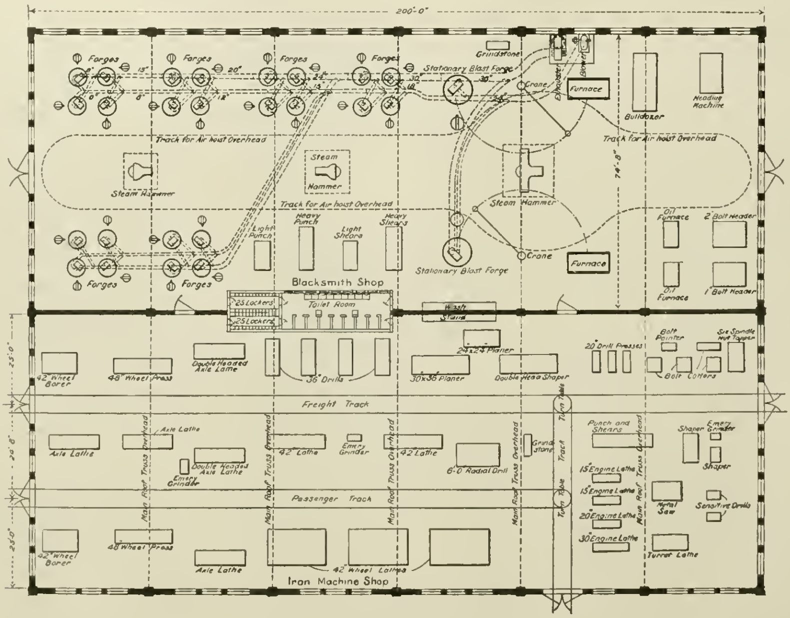
A.—Yes. That is the only way to work a non-lifting injector, and it helps most lifting injectors; makes them work with less noise and more regular.

Q. 105—Will an engine steam any better if this is done?

A.—Yes. Try it by shutting off steam-throttle till injector will pick up all the water for lazy-cock full open, and leave it that way unless steam-pressure drops down very low, when you will have to open steam throttle a little, to give enough steam for the lower pressure.

Q. 106—How should an engine be pumped—continuously from beginning to end of trip, or would you shut the injector off when pulling out after each stop?

A.—Shut off the injector at the same time the throttle is opened to start the engine, and start injector again as soon as lever is hooked up after train is under way, or as soon as steam-pressure begins to rise again after pulling out. By this method the steam-pressure can be held more regular, and be greatest just when you need it to get train under way quickly. When pulling out after a stop, the steam-pressure must be kept up against a large amount being used by the cylinders, the fresh coal put in on a fire that has not



been burning fiercely while engine was shut off, and supply of water put in by the injector. As water rises when throttle is opened, with some engines it is an advantage to ease or shut off the injector for a minute or two at the instant of pulling out, and keep injector at work after shutting off, while fire is still burning fiercely, and thus save that heat which would make engine blow off. This method will help a poor steamer along; if it does that, it will help a good steamer burn less coal.

Q. 107—Will an injector take water from the tank if the air cannot get into the tank as fast as the water goes out?

A.—No. In cold weather sometimes the water splashing around freezes all the air-holes in top of tender. Then the injector will not work.

Q. 108—Is there any advantage in having a boiler moderately full of water when pulling out of a station, or when starting a hard pull for a hill?

A.—Yes. You have a reserve supply of water in the boiler already heated to help hold steam-pressure up.

Q. 109—What makes a boiler foam?

A.—Any greasy or foul substance in the water, such as animal oil, soap, alkali water, etc.

Q. 110—How do you remedy it?

A—If boiler does not foam very badly, would handle the engine very carefully, working her easy, with long cut-off and light throttle, so as to raise the water as little as possible. Change the water in the boiler as soon as it can be done safely, by blowing it out—through a surface blow-off cock is best. Would also fill tank with clean water at the first chance if the water in the tank caused the trouble. As to the care of the boiler while foaming, would shut off steam occasionally to see if water-level would stay above the bottom gage. If water dropped too low, would open throttle, keep engine working steam, put on both injectors and deaden fire till it was certain that there was a safe amount of water on crown sheet.

Q. 111—What is the danger when boiler foams badly?

A.—There is danger of cutting the valves, knocking out cylinder heads, stalling on some grade, or getting on some train's time, because engine cannot be worked to full power; or, with a bad case, of burning the crown-sheet, when water drops low enough to uncover it.

Q. 112—Does water remain the same level when throttle is shut?

A.—No. It will drop as soon as steam stops flowing out of boiler. It will drop if engine is not moving, even if throttle is left open.

Q. 113—What do you do in case water drops too low?

A.—Dump fire and get it out of ash-pan, or smother it with green wet coal.

Q. 114—What is the least depth of water on crown-sheet that is safe?

A.—One gage, as when you have less you do not know how much water you have.

Q. 115—How much water on the crown-sheet with one, two and three gages respectively?

A.—That depends on the build of the engine. Some have 3 inches for one gage, 6 inches for two and 9 inches for three gages of water. Other engines do not have quite so much for one gage, some have more.

Q. 116—Do you consider it safe to run an engine with one or more of the gage-cocks stopped up?

A.—No. All should be in working order. If there was no water-glass in working order and all gage-cocks stopped up, the engine would be disabled, as far as handling a train safely is considered. Because some men have done it, do not think it is safe. Never try it.

Q. 117—Is the water-glass safe to run by if the water-line in the glass is not in sight, and moving up and down when the engine is in motion?

A.—No. You cannot tell the correct level of the water in the boiler. The cocks may be stopped up or closed.

Q. 118—Under what circumstances can it be used to show the height of water if you cannot see the top line of water in the glass?

A.—If water-level is above top end of glass, open blow-out cock at bottom of glass. If water level drops and then suddenly rises when this blow-out cock is closed, it is evidence that water is higher in boiler than the glass will show. If below where it will show in glass, open throttle and start engine ahead quickly. The water will rise and show in the glass, but in this last case deaden the fire.

Q. 119—If gage-cocks are stopped up, or the low-water glass-cock is filled up so water does not come into glass freely, what is your duty?

A.—Get engine and train off the main line, deaden or dump the fire, report condition of engine, and clean out gage-cocks. It is not safe to work an engine in that condition.

Q. 120—Is any more water used when an engine foams than when she carries water well?

A.—Yes. The water passes out with the steam like spray.

Q. 121—What is the effect of using black oil in the boiler and through the injectors?

A.—Some kinds of scale are softened by the black oil that is put in boilers; other kinds of scale are not affected by it. In all cases it tends to keep injectors and check-valves free from scale and in working order. In some cases the thicker part of the oil will settle against the firebox sheets and keep the water away from them, so the sheets get overheated.

Q. 122—Would you use valve or lard oil for the same purpose?

A.—No. It would make boiler foam badly.

Q. 123—What damage does it do an engine to work water through the cylinders?

A.—It is liable to break packing rings, cylinder heads, and do other damage to the engine. It also takes the oil off valve and seat, so they cut quicker.

Q. 124—Is it a good plan to let engine slip at such times?

A.—Never. The practice of slipping an engine when backing away from the engine-house to "knock the water out of her steam passages" is a very bad one, also certain to damage the engine sooner or later.

Q. 125—Is it liable to break the cylinder packing-rings or cylinder heads?

A.—Yes; it is.

Q. 126—In case you got out of water on the road, what would you do?

A.—If out in the boiler, would draw the fire at once and send for help. If out in the tender, would try and bail into the tank and fill up. In a snow-drift you could shovel snow into the tender and melt it with steam from the boiler, keeping one side of tank cold, if possible, so injector would work the water without wasting it.

Q. 127—When an engine dies on the road in the winter what would you do?

A.—If it were freezing, would let all water out of tank, leaving both hose uncoupled, open all joints where necessary to let water out of pipes, blow steam through pipes, if possible, after opening joints. Let water out of lubricator all around, blow off boiler clean and dry, even if it is necessary to take out wash-out plugs after steam-pressure goes down. Disconnect engine to be towed in.

Q. 128—How will you fill the boiler with water and get the engine alive when fire is drawn on account of low water?

A.—Take out safety-valve on the top of dome and fill with pails. If another engine is handy, get her to pump your engine up.

Q. 129—Can an engine be pumped up by towing her with another engine? How?

A.—Yes. Pump the air out of the boiler, and water from the tender will be forced in by the pressure of the atmosphere. To do this, plug up all openings where the outside air can get into the boiler, like the whistle, relief-valves on steam-chests, cylinder-cocks, overflow-valves on some styles of injectors. Open throttle and steam and water connections to injectors or water-pump; put the reverse lever the way engine is being moved and tow her with another engine. She should be towed fast enough to oil the valves through hand oilers, and to form a vacuum in boiler by cylinders pumping air out. Cylinder-packing should be tight.

Q. 130—Can she be filled up with water from a live engine, if you have suitable hose and connections?

A.—Yes; by connecting hose to overflow or delivery-pipe of injector and then to suction of injector of dead engine, or through whistle or safety valve. Some en-

gines have a wash-out plug high enough up to fill boiler to one gage.

Q. 131—How do you take care of an engine with old and tender or leaky flues?

A.—Pump engine regularly; keep as steady steam-pressure as possible; have a bright, even fire; use great care that no strong draft of cold air strikes the flues through the door or holes in the fire near the flue-sheet. If possible, when going in the house leave two or three inches of live fire on the grates after shaking down and raking out the old dead fire. This fire will die out slowly, so engine will cool off slowly. Dampers should be shut after going into the house.

N. B.—If this treatment is necessary to help a leaky engine, it will help keep a tight engine from leaking.

Q. 132—If the top of the stack is covered after the fire is cleaned and engine is in the house, to keep cold air from drawing through the grates and up through flues, will it help to keep flues tight?

A.—Yes, it pays. On some roads it is a regular practice. They have iron covers like the one on water-tanks.

Q. 133—Are you familiar with the working of ——— lubricator?

A.—Yes, sir. I can operate it, clean it out, and keep it in order.

Q. 134—Explain how the oil gets from the cup to the steam-chest cylinders.

A.—Steam from the boiler is connected to the top of the cup, which keeps the condenser or ball at top of cup full of water. This steam also passes down steam-pipes, sometimes located inside the cup, to top-arms over sight-feed glasses, and thence through oil pipes to steam-chest. A water-pipe leads from the bottom of condenser to bottom of oil-tank, so oil will not come up to this pipe, but water can pass down under the oil. The head of water in condenser forces oil out through feed-valves and it rises through water in sight-feed glass to where it mingles with the current of steam from top arm into oil-pipes and then to steam-chest. To bring the oil from top of oil-tank to sight-feed valve there is a pipe running up to top of tank which takes oil to feed-valve till it is fed out, and water rises to top of this pipe. It requires a head of water in condenser to force oil through feed-valves and a full boiler pressure of steam in the cup to make it feed regular at all times, whether working steam or with throttle shut off.

Q. 135—What about the small check-valves over sight-feed glasses; what are they for?

A.—They are put in by the makers to close down in case a glass bursts, and prevent the escape of steam from that side of cup, so the other side of cup can be used. They become gummed up after they are used, so they do not always operate. If they stick shut, the cup won't feed, as oil cannot pass up by these valves.

Q. 136—Are there any other valves between the lubricator and the steam-chest? Why not?

A.—Not in the lubricators that have these check-valves. The oil-pipe, after leaving the cup, should have a clear passage without any valves in it to obstruct the passage of oil or steam. The later style of cups has a very small nozzle or "choke" put in the passage where the current of oil and steam leaves the cup. This is to maintain a steady boiler-pressure in the cup, so it will feed regularly, either shut off or pulling a train. If the openings in these nozzles are too large the cup will commence to feed faster as soon as you close throttle so steam-chest pressure falls.

Q. 137—After filling the cup, which valve do you open first? Why?

A.—Steam-valve should be opened first, then the valve admitting water from condenser to bottom of oil-tank, and when you want to set cup to feeding, with old Detroit No. 1, open auxiliaries next, about one-eighth of a turn, or less; then feed valves. With new cups the auxiliary oilers do not regulate the steam-feeds; the nozzles do this.

Q. 138—If you should fill the cup with cold oil while in the house, would you open the water-valve or leave it closed?

A.—Open it, and also open the valve on boiler enough so steam-pressure would be in cup, unless engine was cold. This steam valve must be open whenever engine is working steam. If engine is cooling off, leave steam-valve on boiler closed, if you think there is any danger of oil siphoning over into boiler when steam in boiler condenses.

Q. 139—How often should lubricator be cleaned out? Why?

A.—If oil is good quality and kept free from dirt while in cans on engines, every two or three months is enough; if gummy oil is used, whenever it does not work freely.

Q. 140—Should sight-feed glass or feed-valve on one side become broken or inoperative, can the sight-feed on the other side be used?

A.—Yes, if you can shut the steam out of top of broken glass, and oil off at bottom of glass, the other side can be operated.

Q. 141—Will any of the lubricators in our service "cross-feed"—that is, feed to the opposite of the engine? Why, or why not?

A.—Yes; some of the old-style cups will. The manufacturers say none of the new-style cups will. A cup can be tested by closing the escape of oil and steam from one side of the cup—say, to the right cylinder. Then if the right-side sight-feed will operate regularly, the oil must be going across and coming out on left side. In this test we expect the left sight-feed valve is to be shut off. Then test the other side in like manner.

Q. 142—Explain the cross-feeding difficulty as experienced in some of the lubricators in service.

A.—With most of the old cups and some of the new ones, if the steam and oil outlet from cup to steam-chest gets stopped up, the oil will rise up through the steam-pipe to other outlet, so one steam chest gets all the oil intended for both of them. If, when the outlet from cup is stopped up or shut, the water fills up this steam-pipe or "equalizing tube" till it stands higher than the head of water in the condenser, it cannot cross-feed, as the low head of water in condenser will not force the oil out through feed-valve against a higher head of water in the equalizing-tube. This is the reason the equalizing-tube is coupled to the lubricator at a higher point than the pipe bringing steam from the boiler. Such lubricators will not cross-feed if steam pipe can drain the surplus water from condenser back to boiler.

Q. 143—Is there a possibility of losing the oil out of lubricator after shutting off both bottom feeds to steam-chest, when engine is allowed to cool down?

A.—Yes, in very rare cases. Some boilers are so tight that when cooled off there is a partial vacuum in them, in which case, if both steam and water valves are left open, the pressure in oil-tank will force oil up through water-pipe and over into boiler.

Q. 144—How would you locate which side the defect was on if balanced valve strips were blowing?

A.—Set the valve on middle of seat so that the oil-hole on top is immediately above the exhaust port. Block the wheels and give the engine steam. The escaping steam will then pass direct to the smoke-stack and the blow will be distinctly heard.

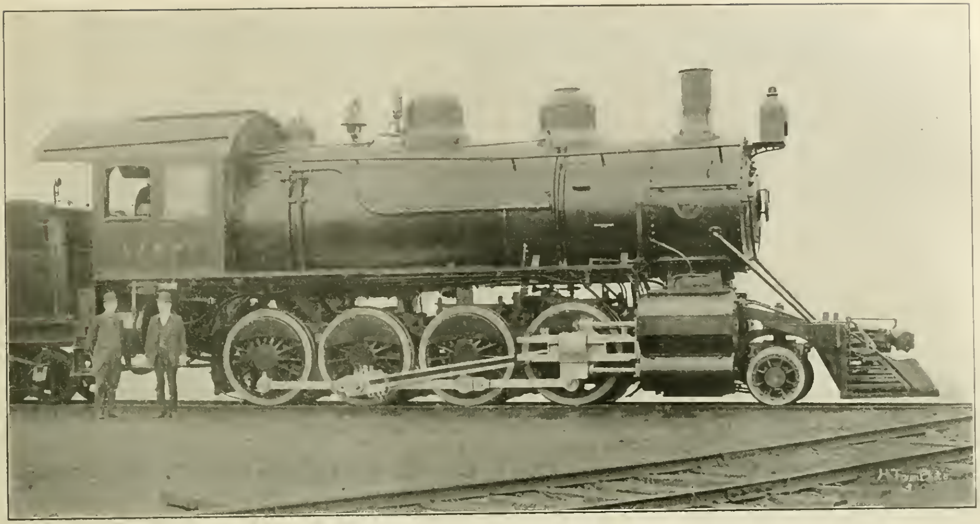
N. B.—These questions and answers about lubricators refer to such styles of cups as the Detroit and Nathan.

Struggle for Mail Contracts.

The Chicago & North Western Railroad Company has organized a series of speed tests between Council Bluffs and Chicago for the purpose of wresting the United States fast mail contracts away from the Burlington system. It will be necessary for the North Western to cut at least 30 minutes off the Burlington's regular schedule time of 10 hours and 25 minutes between the points named.

The Chicago, Burlington & Quincy is 9 miles longer than the Chicago & North Western in the route followed from Chicago to Council Bluffs. By maintaining a speed of 51 miles an hour from start to finish the latter line can reduce the time 30 minutes.

From a local paper we learn that a very large locomotive recently turned out of the Ft. Madison shops of the Santa Fé road took six men to handle the reverse lever. How they all got within arm reach, we are not informed, but our informant would not relinquish any more than one man of the crowd engaged in accomplishing the feat named.



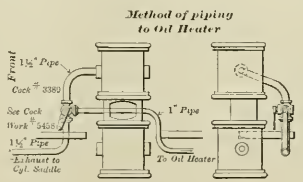
PLAYER-VAUCLAIN OIL-BURNING COMPOUND.

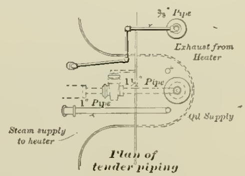
Player-Vauclain Compound Oil Burner.

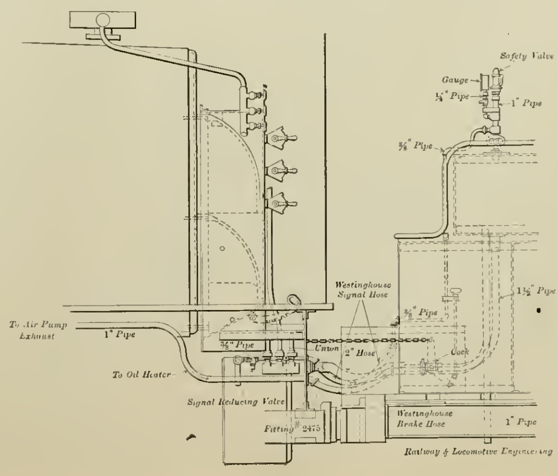
The locomotive illustrated on this page by a half-tone and on next page by line engravings is a particularly notable engine recently built by the Baldwin Locomotive Works. The engine was designed by Mr. John Player, then superintendent of motive power of the Atchison, Tokepa & Santa Fé, and built under the supervision of Mr. S. A. Vauclain, superintendent of the Baldwin Locomotive Works, who imprinted some of his personality upon the engine. The designer and builder are seen standing beside the engine.

On a considerable part of the Santa Fé system they have been for years using oil fuel for locomotives, and the discovery of vast flowing oil wells in Texas has greatly increased the supply of this fuel, which is now abundant in a region traversed by the lines of the system. Liquid fuel has been used in various countries for locomotives for the last twenty years, and the practice has been to burn it in a firebox changed to suit the combustion of oil. As his company were likely to burn oil fuel in a great many locomotives, Mr. Player conceived the idea of designing a special furnace for oil burning, and the engine shown represents these ideas. The furnace, which is the most novel feature, consists of three corrugated tubes, each 28 inches inside diameter and 86 5-16 inches long. The oil burners are placed in the entrance to the corrugated tubes, or furnaces really, which are about the size of the furnace of a marine boiler, and discharge the ignited gases into a combustion chamber, 40 inches long, where the final mixing of the gases is likely to occur. From the combustion chamber 652 tubes, 1¾ inches diameter and 13 feet 7 inches long, convey the products of combustion to the smokebox. The details of this novel boiler are admirably worked out, each furnace is lined with firebrick, and there is a wall of the same material at the point where the burner delivers the oil vapor.

The engine, which is of the regular Vauclain compound type, has cylinders 17 and 28 x 32 inches stroke and the driving wheels are 57 inches outside diameter. The weight on driving wheels is 176,000 pounds. This gives the engine about 43,000 pounds tractive power and a ratio of power to adhesion of 4. The boiler shell is 74 inches diameter at the smallest ring, has a dome 31½ inches diameter and a safety valve turret 15 inches diameter. The working pressure is 210 pounds. There is an unusually large heating surface of 4,266 square feet, 4,031 of that being in the tubes,





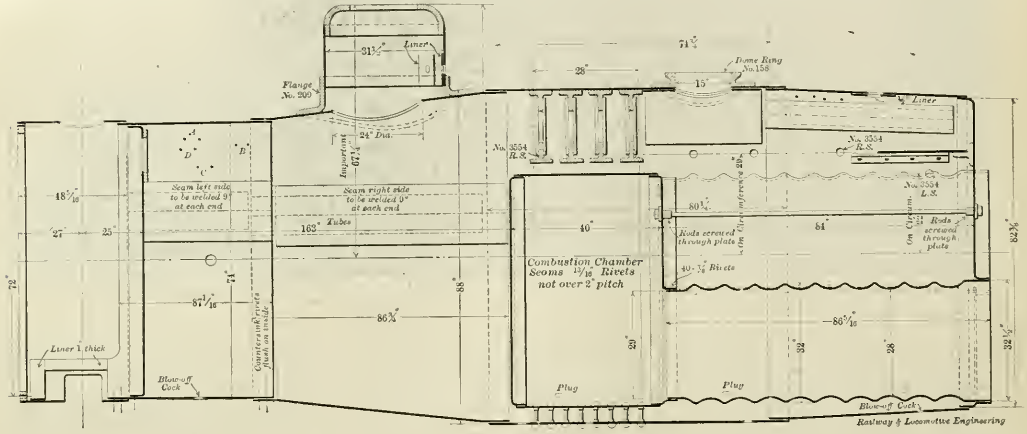


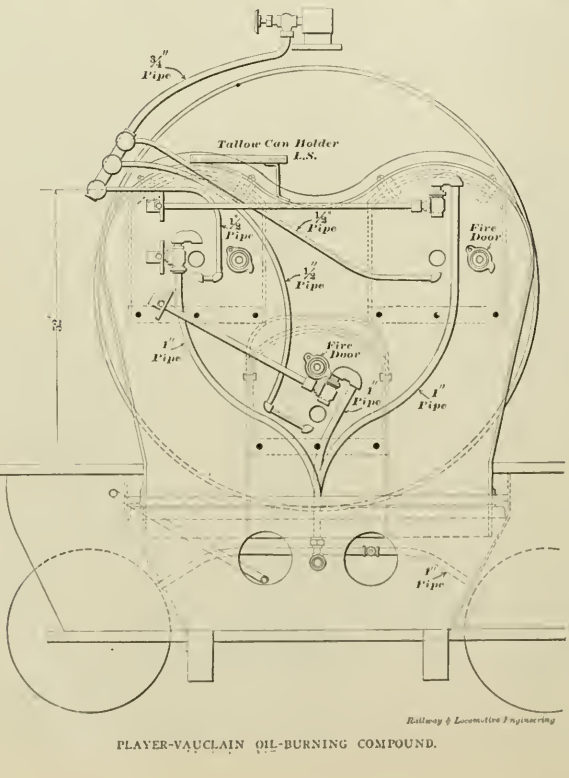
165 square feet in the furnaces and 70 square feet in the combustion chamber. Liberal bearing surfaces are provided for the working parts, as might be expected. The main journals are 9½ x 12 inches and the others 9 x 12 inches. The engine truck journals are 6½ x 10½ inches. The engine has a wheel base of 54 feet 2¾ inches, 15.4 of that being in the driving wheels. The tender is built to carry 6,000 gallons of water and 2,200 gallons of oil.

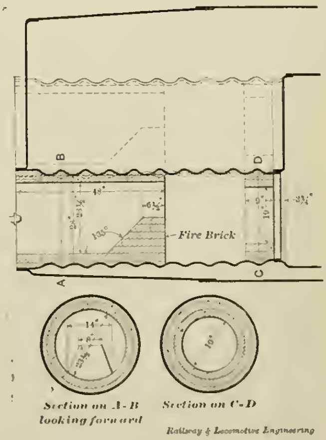
Locomotive Engineers Wanted.

The editor of RAILWAY AND LOCOMOTIVE ENGINEERING has applications occasionally from railroad officials for good locomotive engineers. It has been our practice to keep a list of men out of employment, but at present there is not a single name on the list. Good locomotive engineers willing to work on Southern railways might secure employment by sending us their names and outline of experience. We could secure employment at present for a few machinist engineers on a railway in Central America at good pay.

A patent has been granted to Cornelius Vanderbilt for improvements in his well-known type of locomotive boiler, which are designed to prevent the danger of leakage at the joints of the boiler shell caused by neglect, expansion and contraction of the parts. The improvements re-







duce the weight at the back end and save valuable space in the cab. To attain these desirable results in one structure, the main firebox section, the forward or barrel section and the middle conical section are arranged symmetrically with respect to the common axis, and the rear portion of the firebox section is reduced or tapered to a head which is of larger diameter than the cylindrical firebox, and, furthermore, the flue-sheet is inclined from the vertical, so that it shall stand at right angles to the inclined tubes.

PLAYER-VAUCLAIN OIL-BURNING COMPOUND.

Personal Department.

Mr. J. M. Whalen has been appointed roundhouse foreman of the "Big Four" at Bellefontaine, O.

Mr. F. E. Ramsdell has been appointed trainmaster of the Pittsburgh & Lake Erie at McKees Rocks, Pa.

Mr. R. A. Moore has been appointed master mechanic of the Hawkinsville & Florida Southern, with office at Worth, Ga.

Mr. J. T. Bowden has been appointed general foreman of the Baltimore & Ohio at Grafton, W. Va., vice Mr. J. F. Prendergast.

Mr. William B. Leeds has been elected president of the Chicago, Rock Island & Pacific, succeeding Mr. Warren G. Purdy, resigned.

Mr. C. T. Kalbaugh has been appointed trainmaster of the Youghiogheny and Monongahela divisions, with office at McKees Rocks, Pa.

Mr. B. E. Greenwood has been transferred from Buffalo, N. Y., to Cleveland, O., as foreman of the Lake Shore & Michigan Southern shops.

Mr. C. E. Dafoe has been appointed superintendent of the W. M. & P. division Chicago Great Western, with headquarters at Red Wing, Minn.

Mr. Charles Greenough has been appointed superintendent of motive power of the Bradford, Bordell & Kinzua, with office at Bradford, Pa.

Mr. G. W. Rourke has been appointed trainmaster of the Gulf, Colorado & Santa Fé at Cleburne, Texas, succeeding Mr. W. A. Hyde, transferred.

Mr. Wm. N. Morgan has been appointed purchasing agent of the Virginia & Southwestern at Bristol, Tenn., succeeding Mr. John Warwick, resigned.

Mr. Newton Heston has been appointed purchasing agent of the Seaboard Air Line at Portsmouth, Va., succeeding Mr. R. P. C. Sanderson, promoted.

Mr. G. F. Hawks has been appointed trainmaster of the Galveston, Harrisburg & San Antonio at Houston, Texas, succeeding Mr. H. H. White.

Mr. D. E. Halgarten has been appointed chief trainmaster of the Baltimore & Ohio, with jurisdiction from Garrett to Chicago; headquarters at Garrett, Ind.

Mr. G. P. Johnson has been appointed superintendent of the Virginia & Southwestern, succeeding Mr. C. A. Shields; headquarters at Bristol, Tenn.

Mr. G. H. Goodell, mechanical engineer of the Northern Pacific, has accepted a similar position with the Pressed Steel Car Company, of Pittsburgh, Pa.

Mr. C. C. Reynolds, superintendent of the Chicago and Lima divisions of the Chicago & Erie, has had his office removed from Chicago to Huntington, Ind.

The headquarters of Mr. H. R. Sanborn, superintendent of the Sioux City division of the Chicago & Northwestern, has been removed from Lake City to Sioux City, Ia.

Mr. A. C. Hone, superintendent of the Evansville & Terre Haute, has been appointed superintendent of motive power of the Louisville & Nashville at Louisville, Ky.

Mr. S. E. Moore, the well-known accountant, for many years auditor of Carnegie Steel Company, has been appointed auditor of the Pressed Steel Car Company.

Mr. D. F. Bucher, superintendent of the Chihuahua division of the Mexican Central, has accepted a similar position with the Monterey & Mexican Gulf at Monterey, Mex.

Mr. Frank L. Campbell has been appointed trainmaster of the Vandalia Line at Terre Haute, Ind., succeeding Mr. O. E. Raidy, who goes on the Peoria division in Mr. Campbell's place.

Mr. Wm. Irvine has been promoted from general superintendent of the Chippewa River & Menominee to general manager, with office at Chippewa Falls, Wis., vice Mr. H. G. Chichester.

The jurisdiction of Mr. K. A. Gohring, superintendent of the Toledo division of the Toledo, St. Louis & Western, has been extended over the St. Louis division, vice Mr. J. D Brennan, resigned.

Mr. O. Cornelison, trainmaster of the Chicago Great Western at Dubuque, Ia., has been promoted to superintendent of the Fort Dodge division at Fort Dodge, Ia., succeeding Mr. O. B. Grant.

Mr. James Corbett, assistant superintendent of the Chicago and Lima divisions of the Erie at Huntington, Ind., has been appointed superintendent of the Susquehanna division at Elmira, N. Y.

Mr. J. F. Prendergast, general foreman of the Baltimore & Ohio shops at Grafton, W. Va., has been appointed master mechanic at Glenwood, Pa., succeeding Mr. F. T. Hyndman, resigned.

Mr. W. T. Provence, trainmaster of the Mexican Central at San Luis Potosi, Mex., has been appointed superintendent of the Chihuahua division at Chihuahua, Mex., vice Mr. D. F. Bucher, resigned.

Mr. J. E. Turk, division engineer of the Philadelphia & Reading at Reading, Pa., has been promoted to the position of superintendent of the Wilmington & Columbia division, with office at Reading, Pa.

Mr. J. E. Price, general superintendent of the Intercolonial Railway, has been appointed superintendent of the Moncton & Sainte Flavia district at Campbellton, N. B., succeeding W. Rennells, deceased.

Mr. John A. Greenhoe has been appointed master mechanic of the Gulf & Chicago at Ripley, Miss., succeeding Mr. I. M. Cox, resigned. Mr. Greenhoe was formerly master car builder of the Arkansas Midland.

Mr. O. A. Brown has been appointed trainmaster of the divisions of the Burlington, Cedar Rapids & Northern north of Iowa Falls, Ia., with office at Estherville, Ia., vice Mr. A. H. Tiffany, transferred.

Mr. T. J. English, superintendent of the Middle division of the Baltimore & Ohio at Newark, O., has been transferred to the Pittsburgh division (office at Pittsburgh, Pa.), succeeding Mr. John Barron, resigned.

Mr. E. F. Potter, general manager of the Davenport, Rock Island & Northwestern, has been appointed general superintendent of the Wisconsin Central, with office at Milwaukee, Wis., vice Mr. S. J. Collins, resigned.

Mr. J. G. Metcalfe has been appointed general manager of the Evansville & Terre Haute at Evansville, Ind. Mr. Metcalfe was lately general manager of the Denver & Rio Grande and formerly manager of the Louisville & Nashville.

Mr. H. R. Nickerson has been appointed general manager of the Monterey & Mexican Gulf, vice Mr. A. Monnom, resigned. The Monterey & Mexican has been absorbed by the Mexican Central, of which Mr. Nickerson is general manager.

Mr. F. K. Huger has been appointed superintendent of the Second division of the Seaboard Air Line at Raleigh, N. C., vice Mr. J. M. Turner, resigned. Mr. Huger was formerly superintendent of the Knoxville division of the Southern Railway.

Mr. Avery Turner, superintendent of the Middle division of the Atchison, Topeka & Santa Fé at Newton, Kan., has been appointed vice-president and general manager of the Pecos Valley & Northeastern, which is controlled by the Santa Fé; headquarters at Roswell, N. M.

Mr. R. P. C. Sanderson, general purchasing agent of the Seaboard Air Line, has been appointed superintendent of motive power at Portsmouth, Va., vice Mr. F. H. McGee, transferred. Mr. Sanderson was assistant superintendent of machinery of the Atchison, Topeka & Santa Fé, and resigned last May to go with the Seaboard Air Line. He was formerly for many years connected with the Norfolk & Western.

Mr. J. S. Thompson, recently connected with the mechanical department of the Vandalia Line and for several years connected with the mechanical department of the Ann Arbor Railroad and steamship lines, has been appointed mechanical engineer for the Locomotive Appliance Company, whose general offices are at 1504 Fisher Building, Chicago, Ill.; but for the present Mr. Thompson will make his headquarters at Indianapolis, corner of Twenty-first street and Northwestern avenue.

Mr. W. O. Thompson has been appointed general inspector for the locomotive department of the New York Central & Hudson River, with headquarters at West Albany, N. Y. He will perform such duties as may be assigned to him by the superintendent of motive power and rolling stock in connection with motive-power service on the road and at engine-house. Mr. Thompson has been secretary of the Traveling Engineers' Association ever since it was formed. He was for several years traveling engineer of the Lake Shore & Michigan Southern, and was later connected with railroad supply interests.

Mr. A. M. Waitt, superintendent of motive power on the New York Central Railroad, has been elected chairman of the recently organized Association of Mechanical Officers of the Vanderbilt Lines. This association includes the New York Central, the Lake Shore, Michigan Central, New York, Chicago & St. Louis; the Cleveland, Cincinnati, Chicago & St. Louis and the Boston & Albany lines. It is intended to hold meetings every other month for the purpose of discussing mechanical matters pertaining to the Vanderbilt system of railroads. The association will be similar to one that has existed on the Chicago, Burlington & Quincy for ten or twelve years, and was organized by Mr. G. W. Rhodes.

Owing to impaired health, Mr. John Player, for the last eleven years superintendent of machinery of the Atchison, Topeka & Santa Fé, at Topeka, Kan., has retired to the position of consulting superintendent of motive power, and Mr. George R. Henderson, his assistant, has taken his place. Mr. Player has been in railway service for twenty-eight years and for some time has contemplated taking life more easy than what he could enjoy as mechanical head of a great railroad. Mr. Henderson has been with the Santa Fé since June last, and left the position of assistant superintendent of motive power of the Chicago & Northwestern to go there. He went with the understanding that he would be advanced to the position of superintendent of motive power within two years.

New President of the Safety Car Heating & Lighting Company, Etc.

At a meeting of the Board of Directors of the Safety Car Heating & Lighting Company, held at the offices of the company, 160 Broadway, on Wednesday afternoon, December 11th, Col. Robt. Andrews, heretofore the vice-president of the company, was elected to the presidency of the company, vice Arthur W. Soper, deceased. The vacancy in the Board of Directors was filled by the election of Mr. A. C. Soper to serve on the board. Mr. A. C. Soper is a brother of the late Arthur W. Soper.

Col. Robt. Andrews is well known in railroad circles and has a host of warm friends. He was born in Wilmington, Del. He attended school at the Episcopal Academy at Cheshire, Conn., from which he was graduated in 1849. After leaving

COL. ROBERT ANDREWS.

the Academy he entered Trinity College, at Hartford, where he was graduated in 1853. He then took a course in the Polytechnic College at Philadelphia, graduating in 1854. His first position was that of assistant engineer of the State Canals of Pennsylvania, in which capacity he served from 1854 to 1857; his next appointment being that of principal assistant engineer of the Sunbury & Erie Railroad. He served that company for the three years from 1857 to 1860. From 1861 to 1864 he was staff officer in the army during the Civil War. From 1864 to 1865 he was chief engineer of the Saratoga & Hudson River Railroad, and for the twenty years from 1865 to 1885 he served the Wabash Railroad as division superintendent, chief engineer and general superintendent. From 1885 to 1888 he was general superintendent and engineer of the Virginia Midland Railroad, and from 1889 to 1901 vice-president of the Safety Car Heating & Lighting Company and the Pintsch Compressing Company. This brings his record up to the time of his election to the presidency of both the last named companies.

The New Reading Shops.

One of the largest railroad shops in the country is now under way for the Philadelphia & Reading Railway at Reading, Pa. In fact the erecting shop is nearly ready for use, and the boiler and blacksmith shops are well along toward completion.

The erecting shop is 200 x 740 feet, has seventy pits—thirty-five on each side, with the tools in the center. These pits are cemented of course and have gutters on each side instead of in the center. This insures a dry place for the men to stand at work, without straddling a central gutter.

Induction motors of General Electric manufacture will be used to drive sections of the shafting in various units from 40 horse-power down, and large tools will have separate motors.

The large electric cranes are of 120 tons capacity and a lift of 30 feet. These will lift a 15-foot locomotive over another of the same height. Each bay also has a 35-ton crane for lighter work. One of these will run through to the boiler shop. These are made by the Niles Company. There is also a 10-ton crane in center to serve the shop tools.

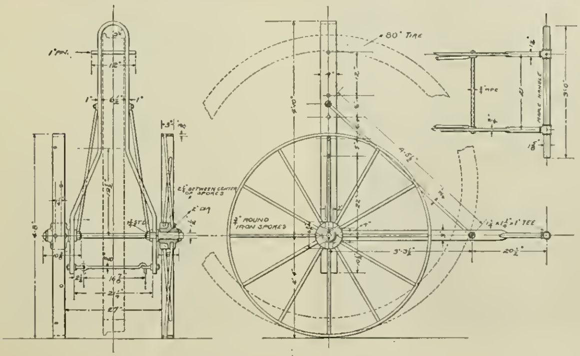
The boiler shop is 70 x 400 feet, and has a lean-to its entire length, which is 50 feet wide. The forge and smith shop is 60 x 550 feet, and also has a lean-to. A track runs through its center. Of the unfinished buildings the foundry will be 130 x 400 feet, and the carpenter shop will be a large, three-story affair. A foundry stock-house, store-house, engine cleaning house with pit and offices are yet to be built.

The power-house is 110 x 175 feet and has a well-designed brick stack. There are eight vertical Wickes boilers, of 250 horse-power each, fitted with Roney stokers. Six engines will be used, all of which rest on substantial concrete foundations. Three of these are of McIntosh, Seymour & Co. build, 600 horse-power each. There are also three Harrisburg tandem compounds, of 300 horse-power, and two 75 horse-power simple engines. A large duplex cross-compound Ingersoll-Sergeant air compressor will supply air for shop tool and other purposes.

When this plant is in running order it will be a Mecca for railway shopmen who want to keep posted on modern methods.

Mr. John Riley, an engineer on the Pittsburgh division of the Pennsylvania Railway, has been presented a check for $500 and a gold watch, valued at $1,000, by the officers of the company for signal bravery in stopping a runaway train last spring. At the same time Engineer William Black and Conductor James Lundy were given checks for $200 each for "courage, judgment and a high sense of duty."

TRUCK FOR HANDLING LOCOMOTIVE TIRE.



DETAILS OF TIRE TRUCK.

PORTABLE COTTER DRILL FOR CUTTING KEYWAYS.

Some Handy Shop Tools.

I am sending you, under separate cover, to-day a sketch and photograph of a truck for handling locomotive tire. You will note that the holes in upright can be spaced to suit any size tire, and by placing tire between the uprights, raising the handle until the hole comes below the bore of the tire, inserting bolt, and then lowering the handles, the tire is raised 1 inch off the floor. Two men can easily handle the largest tire, and with entire safety. It is much quicker and safer than the old way of rolling them.

This being the first contrivance I have ever seen for handling tire, I thought it would be a good plan to publish it.

I am also sending photograph of a portable cotter drill, used in the same shop, for cutting keyways in driving axle for eccentrics. This machine can be made to fit any air motor, and is provided with a ratchet feed longitudinally and a feed up and down. It is doing excellent work.

C. F. Jacobson,
Foreman Machine Shop, Elkhart Loco. Shops, L. S. & M. S. Ry..

Siberia's Railroad.

While we are accustomed to do so, still we are inaccurate in speaking of the Siberian railroad as finished. There are yet some unfinished links in the whole chain reaching from Russia to Vladivostok and Port Arthur, the eastern terminus of the road; and probably a year, or even two, may be required to complete them. This colossal undertaking of Russia is rapidly nearing a successful completion, and the entire world will congratulate her on the marvelous achievement. More than ninety million days' work has been thus far performed on the road, and nearly 20 miles of bridges have been thrown across streams. Although designed as a political and commercial necessity to safeguard and develop the Russian Empire, the Siberian railroad is destined to become a very considerable factor in the world's commerce and to bind the East and West more closely together.

Abolition of Free Passes.

The closing of every calendar year finds the railroads threshing over the old question of abolishing free exchange passes for employés. This year the door seems almost closed to further issuance of free passes. Sufficient influence has been brought to bear to almost complete an agreement between nearly all the lines of the country. However, a number of roads, like the Clover Leaf; Cincinnati, Hamilton & Dayton; Wabash; Wheeling & Lake Erie; Ohio Central, Big Four, Grand Trunk and Canadian Pacific exhibit a tendency to join in a revolt against the anti-pass agreement, and openly express a willingness to continue the practice of issuing exchange trip passes to employés of other roads.

Just why this lean privilege of the railroad employé should be withdrawn is not altogether clear. This employé is not a confirmed and troublesome excursionist who travels much and annoys his superior officers and their associates with frequent requests for transportation for himself and family. On the contrary, necessity re-

quires that he be domestic in his tastes and habits and remain steadfastly at home with his work; otherwise he will be unable to provide for his family those highly prized and valued advantages so dear to him and his which place him on a plane above the ordinary day laborer, like the farm hand or ditch digger. His family must be better housed, better clothed, better fed. His children must be better schooled and better taught. All of these, which make him a better man, a more substantial citizen and of more value to the community and society generally, are usually his; but can only be obtained by his staying at home and remaining at work. All of this, so characteristic of the typical, modern railroad employé, is quickly and effectively placed beyond the reach of him who develops roaming propensities and a desire for frequent use of free passes. True, once or twice a year he may wish to accompany his family on a visit to parents or on a short vacation trip; but this is usually the limit, and does not seem to warrant the harsh legislation the anti-pass agreement imposes.

It is dimly conceivable that the withdrawal of the free-pass privilege from the railroad employé, thus obliging him to pay fare, is suggested to swell the receipts of the railroad treasury; for this increase in either gross or net earnings would be so infinitesimally small as to require the use of several figures to the right of the decimal point in reckoning the percentage of increase. Possibly the space he occupies in a day coach is needed for a revenue-paying passenger. We doubt it. More probably the whole momentum of the anti-pass movement is in reality directed against that incubus horde of politicians, railroad nondescripts, and other parasites who give much worry and concern to railway officials. Indeed, if a poll of users of free passes were taken for a week on trains of one of our trunk lines, the bona-fide railroad employé would doubtless be found in the small minority, and the incubus nondescript largely in the majority.

It would seem that this individual is the fellow the railroads are actually gunning for, under pretense of withdrawing the free-pass privilege from the employé. If this be true, we heartily endorse the railroad companies' action, providing, of course, the bona-fide employé be still allowed his occasional free pass; for not only does the nondescript make himself a nuisance as a frequent and unreasonable applicant for free passes, but only too frequently does he abuse the courtesy by loaning to friends and even selling to scalpers the pass he has none too honestly obtained. This individual should be gunned for with a large calibre weapon loaded with heavy, scattering charge, and the bona-fide, deserving employé be still permitted his occasional free pass.

This discussion recalls to mind the old, familiar story of the fireman who, upon being refused a pass home by his superintendent, was asked whether, if he were working on a farm, he would expect the farmer to hitch up and drive him home whenever he wished to go. The fireman's answer was logical, to the point, and is equally fitting in the present case. He said: "No. But if that farmer was already hitched up, agoing my way, had room and wouldn't let me ride, I'd think him a mighty mean man."

Arthur W. Soper.

In the death of Arthur W. Soper, which happened in New York on December 1st after a short illness, many business circles lose a most popular member whose absence will bring sadness to many friends. Withal a most energetic, effusive and warm-hearted gentleman, Mr. Soper's strong personality touched into friendship every person whose regard was worthy of notice. He was born in Rome, N. Y., sixty-three

COL. A. W. SOPER.

years ago, and was educated in the Rome Academy. When seventeen years old he entered his father's lumber business, but in 1858 entered the freight office of the Rome, Watertown & Ogdensburg Railroad. There pitted against other youths with the same opportunities he pushed himself steadily upwards, his capital in compelling success being assiduous application to business and manifestations of the magnetic energy which was a conspicuous feature of his character.

His immediate superior officer having gone to fill the position of superintendent of the St. Louis, Iron Mountain & Southern, Mr. Soper followed him by invitation to St. Louis. He entered the service of the Iron Mountain road in 1871 as assistant superintendent and rose rapidly to the position of general manager, making him the controlling mind over a great property and left it the best equipped and best operated railroad in the West.

Financial friends with whom he was associated in the West having important property in the East that needed a strong business head to manage, Colonel Soper was induced to move to New York in 1881 and take charge of the Pintsch Compressing Company and of the Safety Car Heating & Lighting Company, also of other important interests.

He was a thoroughly home man with unusually domestic tastes. While he had an unusually large number of club and social friends who sought and enjoyed his company, his principal enjoyment was in the company of his wife and daughter. That in itself is a warm eulogy.

Oil Fuel in Railroad Shops.

The growing use of oil fuel in railroad shops shows that its value is being appreciated and when it becomes generally known that fuel oil contains about 20,000 heat units to the pound (from 1½ to 1¾ times that of coal) oil furnaces will increase even more rapidly. As with other shop appliances, it seldom pays to attempt making them, for it is far better to have the experience of specialists in this line of work.

By far the greatest saving with oil furnaces is in the increased output, although the item of fuel is not to be neglected. The work turned out is stated as being from 50 to 300 per cent. more than is possible with coal or coke, due to the fire requiring no time for "tending" or rebuilding or cleaning out, and allowing the entire attention to be given to the work itself.

There is still another advantage in the practical absence of sulphur or phosphorus to attack the metal. This is of particular value in welding and brazing, as the absolutely clean fire which oil presents allows more and better work to be done.

The Railway Materials Company, Old Colony Building, Chicago, have issued a very interesting booklet on this subject which also describes the Ferguson flue welding, riveting, bolt, forging and tapering furnaces, all of which use oil as fuel. Every shop foreman needs a copy to keep up to the times.

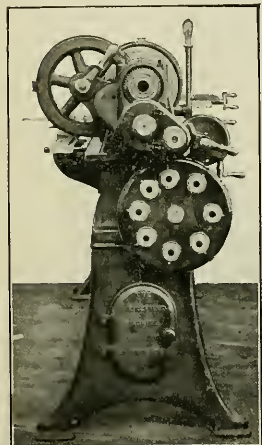
The American School of Corespondence, Boston, Mass., has issued a handbook giving detailed information of their different courses, as well as sample pages from the different instruction books. The methods of the school in the instruction of pupils, the marking of papers and other points of interest are also clearly shown. Those who are interested in study and advancement—and all should be—would do well to get a copy.

We can use about twenty-five more copies of January, 1901, if in good condition. Suitable recompense will be made. Put your name on the wrapper so we will know who to credit with them.

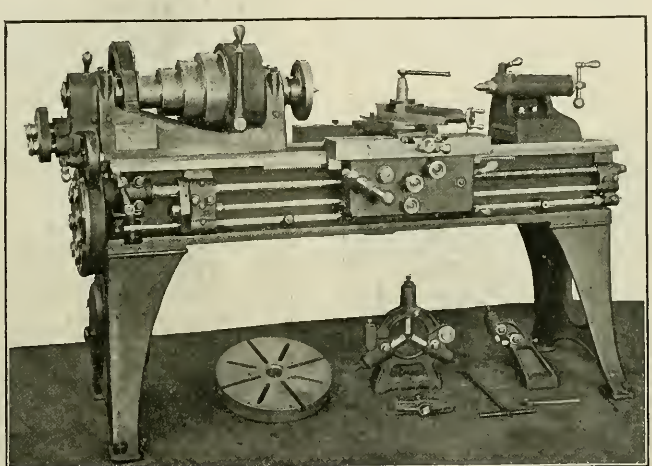
The Ideal Engine Lathe.

Every machinist appreciates a good engine lathe, and though there has been a vast improvement in this tool, the 16-inch "Ideal" lathe made by the Springfield Machine Tool Company, Springfield, Ohio, seems to have gone "one better" in the matter of change gears at least.

The general design is good, the spreading legs accord with modern ideas, and the headstock with its covered gears is neat, convenient and safe. The end view of the lathe strikes one as being peculiar, and proves to be, on account of the latest development of the change-gear problem. The large gear disk carries eight change gears and revolves on a stud. By revolving the disk the desired gear is brought into line with the lead screw. A telescopic extension is thrown into the gear by means of lever shown in front, and connects it as firmly as though held by the nut and washer used in the old-style lathes.



END VIEW SHOWING GEAR-CHANGING DEVICE.



16-INCH IDEAL ENGINE LATHE.

The gear so connected is the only one which runs, all the others being idle. This reduces the entire number of gears in operation between spindle and lead screw to seven for right-hand and eight for left-hand threads.

This, however, will not give a large enough range of threads, and provision is made at headstock by means of three pairs of gears. These give ratios of 2 to 1 and 4 to 1, and by reversing it becomes 1 to 2 and 1 to 4, giving five rates of speed for fixed pinion meshing with intermediate gear. These gears are made similar to those in disk and slip on reduced ends of spindles provided with clutches to engage them. They are thus supported by spindle instead of case, which forms a guard and means of handling. These give a range of threads from 2 to 56 per inch and turning feeds of 8 to 224 per inch. Every change of feeds or threads can be made with lathe in motion.

The reversing mechanism does not require the use of a reversing countershaft for screw cutting, this being controlled from the apron. A friction-geared head spindle to a standard lathe is novel, but is believed to be just as desirable as on screw machines. While it adds somewhat to cost of manufacture and may seem to complicate the mechanism, its advantages are numerous and outweigh any objection.

The spindle is of course hollow, of hard hammered crucible steel, large journals and self-oiling boxes. A separate feed rod is provided, as it is considered preferable to splining the lead screw. A taper attachment is also furnished when desired, which gives all tapers up to 4 inches to the foot and 18 inches in length.

Taken as a whole, it seems to be a very complete tool, and one which will be appreciated by mechanics generally.

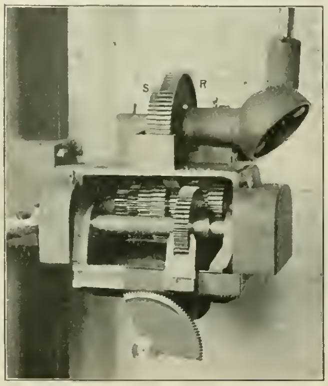
A Practical Lesson in Smokelessness.

It is planned by the managers of the St. Louis Exposition of 1903 to make it a practical demonstration of the fact that the burning of soft coal can be done without smoke. The Smoke Abatement Association of St. Louis has taken hold of the matter with the approval and co-operation of the directors. Not only is the entire exhibition to be smokeless, but the railroads running trains to the exposition will be urged to adopt smoke-consuming devices for their locomotives. This is a most practical idea, and if it can be carried out successfully a service will be rendered to the country greater than such exhibitions are usually credited with. It will be doing what at the present time is eminently necessary to be done, for while there is a movement throughout the West to abate the smoke nuisance, it is hindered and retarded by the coal users with the contention that smokeless combustion is not possible. If it is once shown that it is possible on such a scale as would be involved in the supply of power and light for the entire exposition, and if all the visitors to the exposition can be convinced of it, then smokelessness will be insisted on elsewhere and everywhere. It is much to be feared, however, that the smokelessness will be comparative rather than absolute. Smokelessness to the eyes and other senses of the citizen of St. Louis or of Chicago would probably be a rather different thing from the smokelessness of the New Yorker. The thing to be ultimately insisted upon is not merely the smokeless burning of soft coal, but smokelessness whether or no. If the coal cannot be, or if the users of it will not arrange for it to be, burnt without smoke, then let the public insist upon other arrangements. Let the coal that is consumed for light and power be burnt elsewhere than throughout the large cities, and let the transmission be by electric current, and for the other incidental and domestic uses of coal let gas or coke be employed. As Mr. Tecumseh Swift has already suggested in our columns, it would seem to be perfectly possible to establish electric generating plants at the almost inexhaustible mines of, say, Central Illinois, and to transmit current sufficient to supply the light and power needs of St. Louis and Chicago and all the smaller towns of the region. Where the distances are too great for electric transmission, power houses may be located, say, twenty miles from a city, or even ten miles, and the coal may be brought and used there. Arrangements of this character may be gone into with the result of greater economy in the use of the coal, a matter which is well worth considering now, as it is likely to become imperative later. Smokelessness is a luxury

which New Yorkers enjoy and appreciate. Like all luxuries, it is bound to spread until the common people everywhere shall enjoy it. The wonder is that the smoke nuisance is tolerated as it is, and if the St. Louis Exposition can show that the people living in smoke need no longer do so, and can get them to realize how delightful it is to live without the smoke, then the smoke will have to go. The people need no longer be in the attitude of tamely enduring a nuisance upon the unwarranted assumption that it cannot be cured.—*American Machinist.*

High Speed with the Electric Motor.

In the experiments being held on the German Military Railway between Zossen and Marienfeld, a very high speed of 105 English miles per hour was attained. The motive power of the train was the electric motor. The air resistance of the train was equal to a wind force of about 12 feet per second.



LOWER GEAR BOX. CINCINNATI MILLING MACHINE COMPANY.

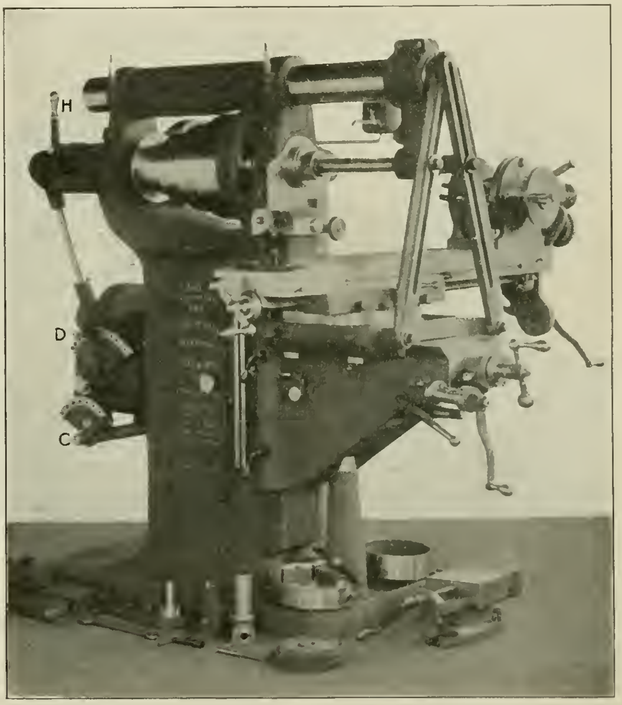
Mr. Charles T. Schoen, who has recently severed his connection with the Pressed Steel Car Company, is making arrangements to build works for the manufacture of steel wheels for cars. The work is to be done on a large scale and it is expected that wheels will be turned out sufficiently strong to bear the service of the heaviest cars under which the cast-steel wheel has been failing badly of late. It is expected that wheels can be made at a price which will rapidly push the cast-iron wheel out of the market for freight-car service.

We regret to record the death on December 17th of Mr. H. B. Underwood, the senior partner of H. B. Underwood & Co., proprietors of the L. B. Flanders Machine Works, of Philadelphia. The business will be continued under the same name by the surviving partner, Mr. D. W. Pedrick, who is well known in railway circles.

The Cincinnati Milling Machine.

The accompanying illustrations show the latest pattern milling machine made by the Cincinnati Milling Machine Company, of Cincinnati. The chief characteristic of this machine is the positive feed mechanism, which is shown in detail. The features incorporated in this construction are: A positive gear-driven feed; a wide range of feed changes; means for changing from any one rate of feed to any other rate of feed conveniently and without stopping the machine.

Part of the mechanism is placed at the rear end of the milling machine spindle and part is encased in a gear box at the rear of the column. The connection between these two parts is by means of a vertically inclined shaft.



NEW CINCINNATI MILLING MACHINE.

The operation of the mechanism is briefly as follows: Motion is transmitted from main spindle to the vertically inclined shaft through gear box *A* by means of shifting gears controlled by lever *H*, which in turn drives the shaft in the lower gear box upon which are mounted the spur gears *R* and *S*, as shown in Fig. 2, through the miter gears, which are of steel, case hardened. All the spur gears also of the feed mechanism are of steel. Inside of the lower gear box will be seen two cones of four gears each, running loose on their shaft and driven independently by the gears *R* and *S*, the smaller gear *S* engaging the largest gear on one cone and the larger gear *R* engaging the smallest gear on the other one, thus imparting widely different speeds to the two cones. From these cones motion is transmitted to the various feed screws through an intermediate gear, which is made to slide on its shaft by means of the rack and sector, and placed into correct position for engaging any one of the cone gears by means of the lever which actuates the sector *C*. The position of this lever at any time indicates the rate at which the machine is feeding in thousandths of an inch per revolution of spindle by means of raised figures on the lever quadrant.

The lower lever having been placed in position to obtain the desired rate of feed, the intermediate gear is brought into mesh with the proper cone gear by the upper lever *D*, which moves the entire lower portion of the mechanism. By this combination of these two mechanisms sixteen different speeds are imparted to the feed shaft, advancing by even graduations from 0.006 to 0.300 inch for each turn of the spindle. The lower lever, acting as an indicator, enables anyone to tell at a glance just how fast the machine is working.

From the foregoing it is plain that by simply shifting the levers on the feed mechanism any one of the sixteen different rates of feed may be obtained, and a change from any one rate of feed to any other may be made without stopping the machine, since there are no change gears to interpose nor belts to shift. Any one of these rates of feed may be used in combination with any of the sixteen different spindle speeds, providing in all 256 different combinations.

The spindle speeds vary from 9 to 350 turns per minute, and have been chosen with a view to secure the proper cutting speed for cutters of standard diameters. The table shows how well this has been accomplished, and also shows how these speeds are obtained for the No. 3 universal machine.

TABLE OF CUTTER DIAMETERS ADAPTED TO THE SPINDLE SPEEDS FURNISHED ON THE NO. 3 UNIVERSAL CINCINNATI MILLER.

	Surface speeds—Feet per minute.		
	Steel, 20 feet.	Cast iron, 40 feet.	Brass, 60 feet.
Spindle speeds.	Cutter diameter.	Cutter diameter.	Cutter diameter.
9	8½	..	..
13	6	12	..
15	5	10	..
19	4	8	12
22	3½	7	10
30	2½	5	7½
34	2¼	4½	6¾
51	1½	3	4½
60	1¼	2½	4
88	⅞	1¾	2⅝
103	¾	1½	2¼
133	⅝	1¼	1¾
150	½	1	1½
203	⅜	¾	1⅛
230	⅜	⅝	1
350	¼	½	¾

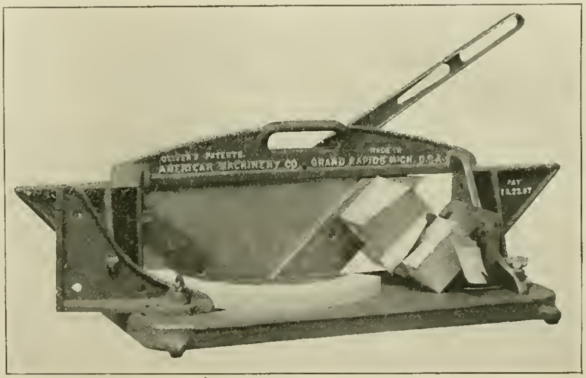
With this mechanism the capacity of the machine for removing metal is only limited by the pulling power of the main driving belt. The rate of feed can be changed practically instantaneously. It is positive at all times, imparting an even motion to the table, thereby avoiding the broken cutters and spoiled work which so often result from a slipping feed belt.

In addition to this feed mechanism there are other improvements on these machines, notable among which are a telescopic vertical feed screw, which does away with the necessity of cutting a hole through the floor.

There are clamping devices which enable one to firmly lock the knee to the column or the saddle to the knee when the longitudinal feed alone is being used, thereby greatly increasing the rigidity of the machine. The sliding covers on the knee protect the feed screws from dirt and cuttings, and a cylindrical overhanging arm, which, in addition to the regular support for the arbor, is also provided with a support which can be adjusted close to the center, supports the arbor at any point in its entire length. These features are common to all the back-geared machines made by this company.

Self Help Made Him Mayor of Boston.

The life of General Patrick A. Collins, elected Mayor of Boston, is an illustration of what self-help can still do for an American boy. His life has been a varied one, and is a shining example of what poor but gifted boys can do with American opportunities. At fourteen years of age he was working in the coal mines of Ohio. At twenty he was a Boston cabinet maker by day and an enthusiastic law student by night. Before he was thirty he was eminent as a lawyer and National Democratic leader. At forty he was in Congress and chairman of the judiciary committee. His last post of public service was as our Consul General at London. Boston workingmen, from whose ranks he graduated, are naturally proud of him.



OLIVER WOOD TRIMMER.

The Oliver Wood Trimmer.

This is one of the handiest tools we know for the pattern shop, and its simplicity seems to be its chief merit. The popularity of the machine is indicated by the fact that during the trying years of 1893-4 the makers—the American Machinery Company—were obliged to run night and day to fill orders.

This was on account of foreign business, which was secured in a novel way. They shipped a traveling outfit to Europe, and with sample wagons drawn by horses the machines were shown in operation in nearly every large machine shop in Europe. Where the salesmen could not speak the language they simply kept still and worked the machine, with the desired result of securing orders. The machines seemed to speak every language.

Of the machine itself little need be said, for its usefulness is apparent at a glance.

Winter is the time for finding out where steam blows through in leakage about a locomotive, and we notice that some of them have great displays of leakage during cold weather. We have known of several cases lately where the makers of metallic packing were accused of having their packing leaking all the time, when investigation showed that it was not the packing but a leaky cylinder head that caused the annoyance. The casing being tight, there was no place for leaking steam to escape, except around the gland, and therefore it was assumed that the packing was leaking.

That the dangers of train operating are slightly increased by the use of oil fuel was painfully illustrated near the end of November in a butting collision on the Santa Fé at Franconia, Arizona. Immediately after the smash the wreck took fire, and two firemen and one dining-car waiter were burned. Four other men lost their lives. The collision is reported to have happened through the engineer of one of the trains having forgotten to stop at a meeting point. Both engines had electric headlights, which ought to have given warning, even though the accident happened on a curve. We never saw a good electric headlight that did not project sufficient light upwards to serve as a warning at night if the effect was intelligently noted.

A new process for applying a coating of lead enamel to iron surfaces by mechanical means, and invented by M. A. Dormoy, was recently described in *La Nature*. The articles to be coated, after being heated to redness, are placed in a double hermetically-sealed chamber with glazed sides; each half of the chamber can be worked alternately, and the surplus enamel powder —dusted over the metal by means of a sieve—is removed from the chamber by the draft from a high chimney. The necessary movements of the iron can be effected from the outside of the chamber, and the vibration of the sieves for the purpose of distributing the lead powder is provided for by an electrical beater.

The Seneca Collision.

A most disastrous head-end collision happened on the Wabash Railroad between two passenger trains at Seneca, Mich., on the evening of November 27th, by which at least fifty passengers lost their lives and about 100 persons were injured. The immediate cause of the accident was a mistake made by the engineer of the East-bound train in reading his orders. The orders directed him to meet the West-bound train at Seneca, and he asserts that he read the order as directing him to make Sand Creek the meeting point.

There are a great many complications connected with this accident which are not easily explained without putting serious blame upon several men. It is the rule on the Wabash that the engineer shall show his orders to the fireman and that the conductor show his orders to his brakemen. All the crew appears to have overlooked the order except one brakeman, who signalled to the engineer to stop when he realized that the train was passing the meeting point; but it was too late, for the accident happened before the brakes could check the speed of the train. The mistake made by that brakeman was that he did not apply the brakes instead of pulling the air-signal cord. So much for the blame resting upon that crew; but in addition to that, the engineers rest under a load of responsibility from which we see no means of escape. The engines of both trains were equipped with electric headlights, yet under the glare of these both trains dashed together in deadly collision. The excuse is offered that the glare from electric headlights is so blinding that an onlooker cannot tell whether it is 100 yards or 4 miles away. That may pass as a very poor excuse in the absence of anything better, but it has the weakness of not being true, and its fallacy is easily proved.

As we have not seen the train order on which the mistake was made, we cannot say if slipshod handwriting helped to deceive the engineer, but we think that likely enough, for many telegraph operators are notorious for their illegible handwriting. This is a matter which ought to receive strict attenton from superintendents, and it is habitually neglected. Some railway companies are extremely particular about making sure that trainmen are closely examined for defects of vision, a wise precaution in preventing accidents by color-blind people mistaking signals; but almost nothing is done to make the operator who writes pot-hook hieroglyphics practice writing plain letters that ordinary people can read fluently.

We have known repeatedly of accidents happening through adjoining stations having names which could be confused with each other. Seneca and Sand Creek do not look much alike when the words are well written, but as pictured by the pencils of many operators they might be made to look very much alike.

The numerous improvements made of late years in train dispatching have greatly reduced the number of accidents that used to happen through mistakes in understanding orders. But there still appears to be room for further improvement. The orders for two meeting points were given in one sentence, and Sand Creek was the last word, which was an invitation to make a mistake.

After all, mistakes will always be common where a single track is employed for carrying a heavy traffic and a system of absolute block signalling is not in use. Block signals reduce the chances of making the mistake that brings trains violently together to a minimum. Many hundreds of miles of single track are now protected on this system, and it ought to be made compulsory for all railroads. It takes considerable courage on the part of a railroad president to decide to equip a long railroad with block signals, but it is a paying investment when it is accomplished.

The coronor's jury which investigated this accident were very sweeping in according the blame. The verdict reads:

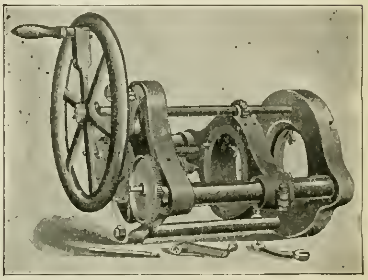
"That said collision was caused by the negligence of the said Wabash Railroad Company and the trainmen of said train 4; said railway company being negligent in a failure to provide train 4 with a head-end brakeman, according to rule 210 of the company, and a failure to provide proper signals at the place of meeting of trains 4 and 13. Engineer Aaron T. Strong is found negligent for failing properly to understand and obey order 82. Conductor George J. Martin was negligent in failing to signal said engineer to stop, and failing to apply the air brake when the engineer did not give the proper signal immediately after the station signal at Seneca, according to rule 41 of the special rules of the said company. Fireman John Bastien was negligent in failing to remind the engineer of order No. 82, when said engineer failed to give the proper signal and slow up at Seneca. Brakeman Anthony W. Dittman was negligent in failing to signal the engineer to stop and failing to apply the air brakes until after the said train passed the station."

Since the above was written another head-on collision has happened between two express trains on the Southern Pacific. Two persons were killed and many hurt. Talking about the cause of the accident the engineer to blame said: "I received my orders at San Ardo all right and the fireman and I talked them over. We both understood them perfectly. The engine was a new one and I was so busy looking after the machinery that I forgot all about my orders until the lights of the switch flashed past. I at once threw on the air brakes and reversed the engine and then jumped. I alone was to blame for the collision."

This is a most emphatic argument in favor of block signals for single lines. There are not many railroad companies operating single-track that do not lose more from wrecks in five years than it would cost to put in an equipment of block signals that would absolutely prevent trains from coming violently together.

An Improved Crank Pin Turning Machine.

Although portable crank pin turning machines have been in use for a number of years, the one illustrated herewith is of new design and has a number of good points not possessed by the old type machine. It is a light machine, the small size which will go over a 6½-inch collar, weighing but 253 pounds; while for an 8½-inch collar the additional weight is but 18 pounds. As will be seen, it will go over the collar and is adjustable for any sized pin within its capacity. It will feed in either direction and has enough power



CRANK-PIN TURNING MACHINE.

to do its work easily. There are two feed screws, one on each side, which give an even travel to the cutter-head, insuring a smooth crank pin.

The Lehigh Valley Railroad have issued a circular for the information of railroad companies, saying that the company will not accept for movement over its lines cars constructed with iron pipes as sills and castings for end sills. That seems to be a final kick at the pipe-constructed car; for which such great claims were made ten or twelve years ago.

The Blackwell, Enid & South Western Railroad have just purchased of F. M. Hicks, of the Hicks Locomotive & Car Works, of Chicago, two 50-ton, 18 x 26 cylinder modern freight engines and one 17 x 24 passenger engine. These locomotives have American driver brakes, 9½-inch Westinghouse air pumps, E-6 engineer's brake valve, air bell-ringer, air sander, U. S. metallic packing, asbestos lagging, 4,000-gallon tanks.

The Pennsylvania Railroad Company have ordered 180 new locomotives from the Baldwin Locomotive Works. They are of a variety of types and are all intended for freight service.

Problems in the Management of a Railway Shop.

BY R. T. SHEA.

Progressive railway officials are constantly figuring on how to save a few pounds of coal every trip, a pint of oil or how to haul one more car, or its equivalent in tons, over the road, and it is right and proper that they should. Many of them will tell you at a moment's notice how many thousand dollars they have saved on any of these items, and yet if you would point out to them that by the expenditure of a little energy and encouragement in other directions in our large railroad shops, the saving made would be so large as to cause them to wonder why this was not done before. One of the reasons why the leaks in some of our large shops are not looked after more closely is, that the master mechanic and his assistants are very busy men with a large amount of routine duties. The master mechanic, in addition to his shop work, usually has charge of one or more divisions of the road, which requires a great deal of his time to look after. The many routine duties in the shops press the foremen to their limit, and in their anxiety to get out a certain number of cars or engines per month and their close attention to the every-day details they have very little time to figure increased output and decreased cost, and in many cases they become hardened to the wrongs that they know exist from seeing them so long, and they also realize that it is a very difficult problem to make radical changes of any kind in shop management and they hesitate to do it, fearing to incur the enmity of their subordinates and possibly not get the required backing of their superiors.

The following cases will be cited as illustrations of the chance for saving in some of the larger shops:

Attention was called recently to a very fine hopper-bottom coal chute, with all necessary lifting machinery, erected at a cost of several thousand dollars, and which they claimed would effect a saving in the handling of coal over the old method of at least 3½ cents per on, or $7 per day. Much time and persuasion were used to get it, and the saving was at least $200 per month, or $2,400 per year, which would pay the interest on a large amount of money at 4 per cent. The shops at this point were then discussed and we found them to be modern and well equipped and the pay roll showed that they employed about fifty machinists and turned out four engines per month, with heavy repairs. In the same locality another shop, not quite so large, was turning out four engines per month, with heavy repairs, of about the same class, and instead of having fifty machinists on the payroll they had twenty, or thirty men less. Allowing $2.50 per day as an average, the second shop was doing the same work for $75 per day less, or $1,950 per month, or $23,400 per year—enough saved in this one shop to pay the salary of the general manager over the first shop, or pay 4 per cent. interest on a great deal larger amount than the first case cited.

Attention was recently called to a new modern plant that did not cost less than $1,000,000, with a capacity for turning out one engine per day and cars in proportion, fitted with every known modern improvement, yet this shop is working less than one-fourth of its capacity, turning out, for general repairs, five or six engines per month. This road has a number of smaller shops and roundhouse plants scattered along the lines, where two or three engines can be repaired in a crude expensive way. All of the small shops run at full capacity. If the reverse were true and the larger shop run at full capacity and the smaller ones doing only actual running repairs, the saving that this road would make would, no doubt, pay the president's salary.

While it is generally admitted that a railroad plant cannot be easily put on what is known as a commercial basis, on account of so many local conditions entering into it, and while radical changes of any kind have got to be handled with a great deal of diplomacy, there is no reason why the argument should be advanced that "we have always got along this way, why change?"

While many of our railroad shops are models of neatness and are all that could be desired, the average run of shops are not, and there is nothing that pays better on the investment than shops thoroughly whitewashed and kept clean, with everything in order and a general air of tidiness in all departments. Dirty tools and machines and parts of engines and cars piled promiscuously all over the shops and around on the benches, and disagreeable surroundings are generally the last places to get good results.

It will generally be noticed that where the output is the greatest the shops are the cleanest and the conditions are the best. Where enough energy is displayed to work the shops full capacity there is also enough energy shown to keep the shops in the best possible condition. Many shops have too much machinery for the output and either one of two things should be done: increase the output or send the machinery to some other point where it can be used to advantage. The men know better than the officials when there is enough work to keep their machines profitably employed and if they are working by the day they will manage to make the job last until another appears; if they are working by the piece, of course this matter will take care of itself.

It might be well to cite that in some cases the treatment of the men in the ranks helps to bring about many of these undesirable results. The line between the men and the officials is often too clearly drawn. If it were possible to educate every man around the plant to the fact that the success of the plant depended to a great extent on his individual efforts many of the poor practices would not exist.

Whenever the queston of increased output is argued, the defense is "poor work," but it is not a logical argument, because as a rule, where output is the greatest, quality is generally the best, and if the work is not up to standard, the supervision is at fault and should be changed.

If a ticket agent is a few dollars short in his accounts when the auditor calls, an other man succeeds him; if an engineer runs through a switch, serious trouble is in store for him; if a brakeman happens to fall asleep and is not on top going through every station, another brakeman; if a passenger conductor, by an inadvertence, neglects to turn in a 25-cent fare, another man wears the uniform. And yet in our shops, where from a few hundred to a few thousand dollars, in many cases, are being spent that could be saved, no penalties are attached.

Managers carefully study the payrolls each month and note increases and decreases, but, when this is analyzed, nothing could be more misleading. A given amount of money can be spent with a very small output or with a correspondingly large output, and it would seem as though some method should be devised that would show the output of a shop for every dollar expended, rather than dollars expended this month, this year, as compared with the same month last year.

The question now arises, what are we going to do to bring about the saving proposed? The answer to that is, that each shop has its own particular disease, and a careful diagnosis must first be made and treatment prescribed suitable to it, a careful comparison of the engines turned out per month and the cost in a shop that is considered up to date with one that is not; and then apply the remedy, pay men according to their ability and the work they produce, rather than for the title they bear.

Haggard & Marcusson, of Chicago, who manufacture an excellent cab seat and sell it at a very low price, have recently made some improvements on the seat which increase its value as an anti-bone shaker. It is a great source of comfort to men who have hard-riding engines. We advise all sufferers from the jolts and vibrations that are a weariness to the flesh and frame to send $2.00 for the seat. It is worth ten times the money.

A locomotive tender is becoming such a huge thing with its 5,000 to 7,000 gallons of water and 10 tons of coal, that a good, substantial frame is needed to carry it. Some master mechanics still insist on wooden frames being used for their heaviest tenders.

30-Ton Box Car With Steel Underframe

BUILT BY THE AMERICAN CAR & FOUNDRY COMPANY FOR THE PHILADELPHIA & READING RAILWAY.

The accompanying illustration and drawings show a box car with steel underframe designed and built for the Philadelphia & Reading Railroad by the American Car & Foundry Company at their Peninsular plant, Detroit. This car has pressed-steel sills 34 feet 7 inches over all. The central portion of these sills, for 6 feet 6 inches, is 1 foot 5 inches deep, while the depth at the ends of the sills, for 6 feet 5¼ inches from each end, is 10 inches. The intermediate portions taper from the central to the end depth. The center sills are 1 foot 6 inches apart, and are held in position by malleable iron separators, as shown in the drawing. The end sills are 12-inch channels, which are reinforced in the center by the cast-steel striking plate which is secured by ⅞-inch rivets. The American Car & Foundry Company's twin spring draft gears with cast-steel draft lugs are used. The bolster fillers, four in number, two to each bolster, are made from 10-inch I-beams and connected on top and bottom by 5-16 inch plates running across the car. The bolster center filler is of malleable iron riveted to the center sills on the sides and to the connection plates on the top and bottom. The diagonal end bracing is made from 3 x 3 x 5-16 inch angles, and is shown on the drawing. Southern pine stringers, which run the entire length of the car, provide means for securing the floor. Two doors are fitted to each side of the car, one being made of oak slats ⅞ x 2¾ inches spaced 1½ inches apart, while the solid door is constructed in the regular manner. These two doors are connected and hung on a track extending on both sides of the doorway, so that either door can be moved in position to cover the opening. The slat doors are used when it is desirable to ventilate the car, while the others are used in the ordinary manner. The framework, bracing, and roof construction are plainly shown on the drawings and will require no description.

The cars are carried on Fox pressed-steel trucks with pressed-steel center plates and standard axles with 600-pound wheels. The McCord malleable-iron journal boxes and the Westinghouse air brakes are used. The general dimensions of the car are as follows:

Length inside—34 feet.

Length over roof—35 feet 1¼ inches.

Length over end sill—35 feet 8 inches.

Width inside—8 feet 6 inches.

Width over eaves—9 feet 10 inches.

Width over all—10 feet 2 inches.

Height, floor to top of side plate—8 feet 6¼ inches.

Height, top of rail to floor—3 feet 11⅜ inches.

Height, top of rail to eaves—12 feet 7¾ inches.

Height, top of rail to top of brake mast —13 feet 8 7-16 inches.

Cubic capacity—2,312 cubic feet.

Center to center of truck—24 feet 6 inches.

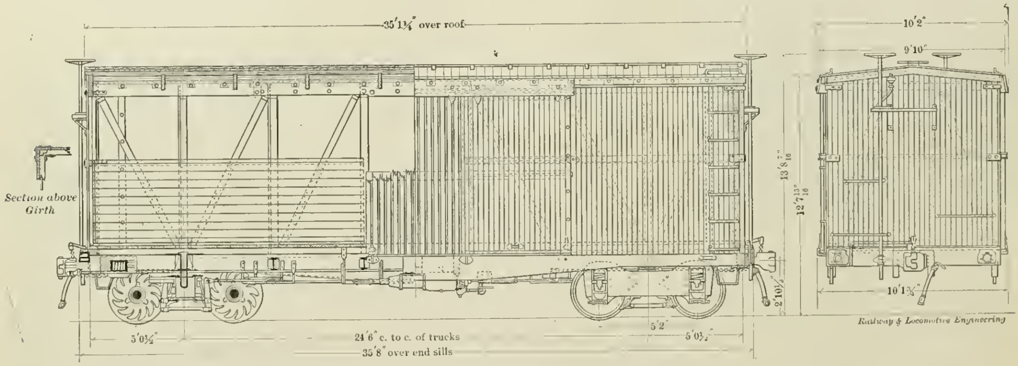
Size of journals—4¼ x 8 inches.

Truck wheel-base—5 feet 2 inches.

Scale weight—31,100 pounds.

Capacity—60,000 pounds.

Ratio dead weight to capacity—52 per cent.



30-TON BOX CAR FOR PHILADELPHIA & READING RAILROAD, BUILT BY AMERICAN CAR & FOUNDRY COMPANY.

Development of Transportation in the United States.*

BY ANGUS SINCLAIR.

MECHANICAL AND BUSINESS PROBLEMS.

Lord Bacon truly says that there are three things which make a nation great and prosperous—a fertile soil, busy workshops, and easy conveyance of men and commodities from place to place. The history of the world has proved Bacon's words to be true, but there have been nations blessed with a fertile country and busy workshops which have tried to get along without easy means of transportation, because of sectional differences concerning the defraying of the expense of constructing artificial arteries of intercommunication. The regions served by water transport were opposed to building roads for the convenience of localities remote from sea, lake or river, and thus conflicting interests retarded the progress of some countries for the time being and left great spaces of fertile regions undeveloped.

In the course of two-thirds of a century a vast wilderness on the American Continent has been changed from gloomy, untrodden forests, dismal swamps and pathless prairies into the abode of a high civilization. Prosperous States, teeming with populous towns, fertile farms, blooming gardens and comfortable homes have arisen from regions where formerly savage men and wild animals were the sole tenants. A powerful factor in effecting this beneficent change has been the building of railroads.

EARLY PRESSURE OF PRODUCTION UPON TRANSPORTATION.

Projects for providing facilities of transportation by rail originated almost simultaneously in the British Isles and the United States. Both countries were badly supplied with highways on which wheeled vehicles could convey heavy loads; both had tried canals and found them unsatisfactory in some respects. The increase of production of commodities faster than the means of moving them led enterprising men in both countries to look in the same direction for relief.

The conditions of urgent necessities which led to the inventing of the steam engine were repeated as the volume of produce and merchandise to be carried went beyond the capacity of water carriage and inferior roads. The steam engine came when great properties were deteriorating because horse power was incompetent to concentrate great effort in limited space. It was a foregone conclusion that the steam engine would be applied to locomotive purposes as soon as the horse proved unequal to the work of supplying the motive power for roads and canals.

The application of steam to water transportation delayed for a time the advent of the locomotive, but thoughtful men had

* Extracts from paper prepared for the Year-Book of the Agricultural Department of the United States.

glimpses of what the steam engine might do in moving loads on land almost as early as attempts were made to use steam in propelling boats.

THE RAILROAD TRACK.

The railroad structure provided a way for the wheels of a vehicle to run upon a smooth, hard surface, where obstacles to progress, such as sinking of the wheels into soft places and mounting over stones or other projecting obstructions, would not be encountered. Such roads were to be found in various localities hundreds of years before the steam engine was invented. There are many traces of what were really stone railroads to be found in parts of Asia and Africa, where an advanced civilization flourished thousands of years ago. The rows of huge stone blocks, worn with myriads of wheels, are in many places the most substantial traces of an enterprising people long passed away. The writer has seen in the streets of Italian cities stone blocks laid down parallel, with a depression to keep the wheels of vehicles in place, and these make as smooth a roadbed as the inside surface of car-track rails provide for the truckmen of our large cities.

For hundreds of years stone ways were used in Germany and other countries in connection with quarries and coal pits. They were introduced into Great Britain in the eighteenth century. This kind of crude railroad was known by the name of "tramway," and Englishmen say it originated from the name of Outram, a noted individual, who took some interest in pushing these friction-reducing roads. As the word "tram" is German and has been used by all northern nations for a thousand years, the claim of Outram to the word is not acceptable. His name probably originated from the word, which was given to the man who drove the oxen outside of the trams of the plow. Outram was the outside man.

Burns, who wrote before Outram's time, in his "Inventory," says:

"An auld wheelbarrow more for token
Ae tram and baith the legs are broken."

In the days anterior to railways the intercommunication between the people of different districts in Great Britain was not at all intimate, but those with the same interests seemed to find out what the others were doing. The British Isles are inflicted with rain, and rain is not good for dirt-made roads. It is, then, easy to imagine how well the invention of some coal miner was regarded who introduced tram rails to carry the wagons from the mine to the staith, or wharf, where the coal was dumped into ships.

One could not tell the coal-mining world of Great Britain at the beginning of this century much that was new about trams. The tramway began with long blocks of stone, that gave place to parallel wooden stringers for the wheels to run upon. The hand of progress covered the stringers with iron strips. Then someone found out that a cast-iron rail simplified matters and a flange was put upon the wheels to prevent them from jumping the track. This was the condition of the world's "permanent way" when people of advanced ideas proposed to use it for steam-driven locomotives.

NEED OF THE LOCOMOTIVE.

The nineteenth century had not advanced many years when people in the United States began to realize that something better than canals was necessary as a means of intercommunication if a great part of the nation's territory were to be opened up to settlement and civilization. There are numerous navigable rivers and long-reaching lakes on this continent, but geographically they are far apart, and there is no means of reaching vast regions except by land transportation. To the ordinary thinker a system of substantial macadam roads would have solved the difficulty as far as draft animals could have aided, but these roads were not tried to any extent.

The pinch of necessity wonderfully quickens the inventive faculties. Long before a mile of tramway was built in the United States in connection with coal mines, engineers and far-seeing public men were discussing the possibilities of the steam engine as a means of accelerating land travel, and projects began to be agitated in different States to construct railways, or tramways, on which the steam engine could do the work of hauling the cars.

Those who looked favorably upon steam engines as motive power on railroads were a small minority, and they were considered by the majority as cranks and visionaries. Those regarded as sensible, progressive men, a little ahead of their time, favored horses for motive power.

The problem that public men were interested in was: How are we going to move our merchandise and coal and ore to the nearest point of water navigation? The transportation of passengers received little consideration from the early railroad schemers.

It might be here mentioned that had James Watt never lived, the use of the steam engine for transportation purposes would have been given to the American people just as soon as it was. Oliver Evans, a native of Delaware, invented the high-pressure, high-speed engine as an improvement on the Newcomen atmospheric engine when Watt was working out his ponderous slow-moving improvement on the same engine. The United States has been the land of high-speed, high-pressure engines, the type most suitable for locomotive purposes, and Oliver Evans was the originator.

The need for the locomotive was much more urgent in the United States than it was in any other country. There were long stretches between Western rivers and Eastern estuaries that needed to be connected. There were no well-constructed roads of any consequence, and such roads, had they existed, could not have offered rapid transportation, so the railway was the chief hope of connecting the remote territory with markets and the seaboard.

FIRST AMERICAN LOCOMOTIVE.

The first American locomotive that was tried on the American Continent to run on rails was imported from England by the Delaware & Hudson Canal Company. It was selected and brought here by Horatio Allen, a pioneer engineer, who was interested in railroad enterprises. The engine was taken to Honesdale, Pa., and tried there in August, 1829. Mr. Allen reported that it was too heavy for the railroad structure, and its use was given up. The engine weighed only seven tons, and there was some diversity of opinion about its being too heavy for the railroad, but Mr. Allen's decision was final. Several engines of the same type worked for years successfully on English railways. From what is known about the structure of the Delaware & Hudson road, engineers now agree that it was sufficiently strong to support twice the weight of Allen's engine, known as the "Stourbridge Lion."

The first thirty years of the nineteenth century were for Americans the period of speculation about the probable success of railroad building and the utility of the locomotive. Then the people set to work to build railroads, and within ten years (1840) the country had 2,775 miles of railroads and tramways.* For a few years there was decided uncertainty that the locomotive would be a practical form of motive power, and Allen's fiasco with the "Stourbridge Lion" helped to make the capitalists who were investing their money in railroad building timid about ordering locomotives while they could operate their cars with horses.

EARLY RAILROADS AND LOCOMOTIVE BUILDING.

The South Carolina Railroad Company was one of the earliest in the world to decide that its railroad should be operated by locomotives, and the operation began in 1830, very soon after the beginning in England.

People of Baltimore, who have always shown much zeal in supporting enterprises likely to bring trade and commerce to the city, obtained in 1827 a charter from the legislature of Maryland to construct a railroad from Baltimore to a point on the Ohio River. The building of the Baltimore & Ohio Railroad was begun without loss of time with imposing ceremonies. In the early part of 1830 the road had been finished from Baltimore to Ellicott Mills, a distance of 13 miles, and the company began operating that part by horses. There were several sharp curves on the route, and a belief was general that a railroad having curves could not be operated by locomotives. Peter Cooper, whose fame as a philanthropist is well known, was a

*Report on Transportation by Land, Eleventh Census by Henry C. Adams, special agent, p. 6.

resident of Baltimore at that time, and he did not share the popular belief that locomotives would not be capable of working around curves, so, to demonstrate the faith that was in him, he built a small locomotive in the Mount Clare Shops, Baltimore, and tried it on the road. It was a very tiny affair of about 1½ horse-power, but it proved that a locomotive could haul a load on a curved road.

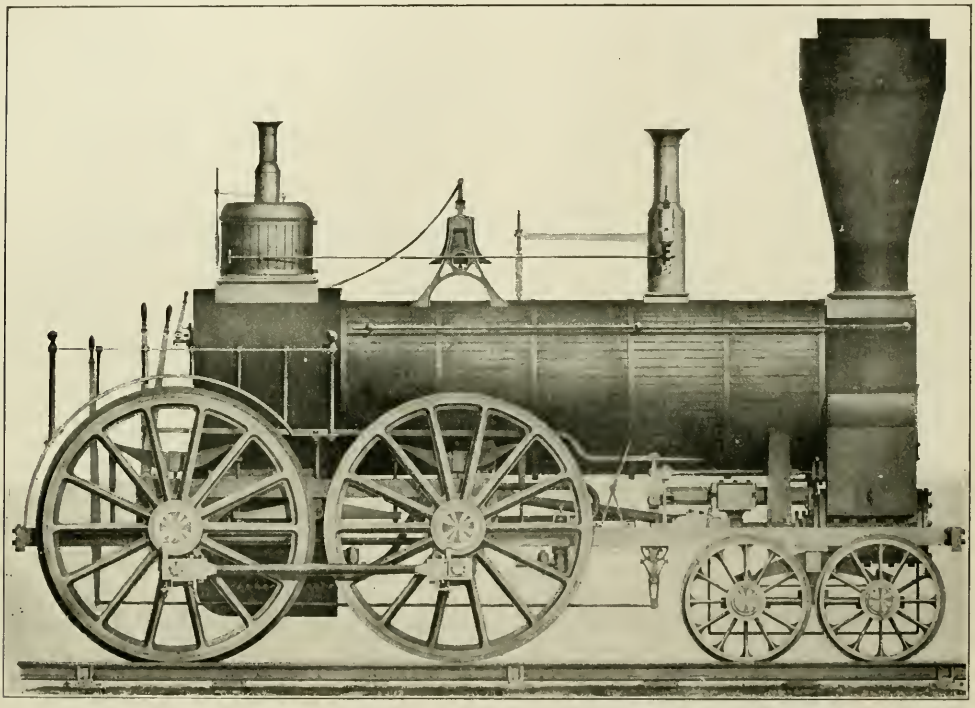
Cooper's experiment increased public confidence in the efficiency of locomotives, and the demand for this kind of engine increased quite steadily as pieces of railroad were finished.

Machine shops capable of building locomotives were not very numerous, but a few shops undertook the work and succeeded very well under the circumstances. The first practical engine intended for everyday work was built by the West Point Foundry, New York, for the South Carolina Railroad. It was a small engine, with a vertical boiler, but it worked as satisfactorily as the English locomotives built at the same time (1830). The West Point Foundry continued to build locomotives for a time, and improved on the design and capacity of the first engine. Among their most celebrated productions was the "De Witt Clinton," built for the Mohawk & Hudson Railroad.

Shortly after the experiment with Peter Cooper's model locomotive on the Baltimore & Ohio the management of the company advertised for locomotives of American manufacture, offering to pay liberally for them. In due time this brought five engines, all built at different places, all different in design, and none of them imitating English models. The preference was given to an engine built by Davis & Gartner, of York, Pa. This engine had a vertical boiler and was for a time the type of locomotive used by the Baltimore & Ohio Railroad.

After this there were locomotive-building shops to be found in several towns. Mathias Baldwin had entered the business the year previous, and his "Ironsides," the second locomotive built in the United States, was running on the Germantown road, where it was doing good work, although the company published a standing notice that the locomotive would start daily with a train of passenger cars if the weather was fair, but that on rainy days horses would pull the train.

By 1840 there were about 270 locomotives working on 56 railroads that were partly finished; but the greater part of the mileage was still operated by horses. It may seem surprising that so many locomotives should be employed on such a short mileage when horses were doing most of the work, but a locomotive during the first railroad decade was very little larger than the fire engine of to-day, and great care was taken to prevent it from working hard. The weight of the first Baltimore & Ohio regular locomotive was 3½ tons.



HINKLEY & DRURY, 1845—AN INTERESTING SPECIMEN OF AMERICAN LOCOMOTIVE DEVELOPMENT.

IMPROVEMENTS IN THE ENGINE.

The first direction that the improvement of rolling stock took was the extension of the wheel-base of the engine so that the weight should be distributed over as much rail length as practicable with the lightest possible weight on any one spot. This movement was really begun in the United States, when, in 1831, John B. Jervis, chief engineer of the Mohawk & Hudson Railroad, put a four-wheel truck under the front end of an engine that was built under his supervision. This worked so well on weak, uneven track that it was gradually adopted by nearly all American railroads.

The coal railroads of Pennsylvania Maryland and New York, which frequently had more business than their motive power could handle, began using engines about the middle of the century which were extraordinarily heavy and powerful for that time. The companies using those engines could afford to build and maintain very substantial permanent way, which was not the case with the average railroad company. At the same time the engine for

ordinary train service was working into an established form. By 1860 engines weighing about 20 tons were becoming common, and most of them were carried on two pairs of coupled driving wheels and a four-wheel truck in front. That form came to be known as the "American" engine, and it held almost exclusive control of the motive-power field with regular enlargements until about 1880. These engines were suitable for any service, passenger or freight, when used on fairly level roads, and are to-day the most popular motor ever put in front of a train.

The locomotive of 1900 is an example of steady evolution, and its leading features are survivals of the fittest. Vast improvements have been made in quality and finish of material. Certain important changes have been effected, among which these may be mentioned: The putting of iron and steel into frames and driving wheels that formerly were partly of wood; counterbalancing the driving wheels; making the firebox suitable for burning coal instead of wood; using equalizing levers between the wheels; placing the cylinders horizontally instead of vertically or inclined; using steel tires instead of iron; using steel for boilers instead of iron and for fireboxes instead of iron or copper; using iron or steel for tubes instead of brass. All these improvements have helped to increase the durability of the engine, to make it more efficient, and therefore to enable it to reduce the cost of hauling mile-tons of freight or passengers. Other changes made in the interests of economy are extremely high boiler pressure, increase in size, and using the steam on the compound system.

CONSOLIDATION AND EXTENSION OF RAILROADS.

It has already been mentioned that most of the early railroads were built to connect towns or waterways. They were mostly short roads that did not attempt to co-operate with one another in moving freight or passengers beyond their own limits. This led to very annoying delays and extra handling of freight. The line, for instance, between Albany and Niagara was in the hands of many separate companies that seldom worked in harmony, and nearly all other lines that were links in through routes were managed in a similar manner. By 1850 the people had become tired enough of the unnecessary discomforts endured on long journeys, and they began to demand radical reform. This gave personages who became known as "railroad kings" their opportunity.

ECONOMICS OF THE GAGE.

In connecting disjointed lines the consolidators lost an opportunity which may cause much inconvenience in coming years. They found a great variety of track gages and chose the narrowest, 4 feet 8½ inches, now known as the standard. That gage is too narrow for admitting of a properly designed boiler upon a large locomotive. Many locomotives are already at work that have reached the limit of their capacity, because the limited gage prevents the boiler from being made larger. To obtain a large boiler it has been raised as high as bridges and tunnels will admit, and it cannot be made any longer with economy, so that the question has been raised whether this country has not already nearly reached its limit of cheapness in railroad transportation. If the gage had been made 6 feet, the Erie standard, or 5 feet 6 inches, which was the gage of many Southern roads and that of Canada, the possibilities of making railroads compete successfully with water carriage would have been greatly increased. When all the leading railroads use locomotives of the greatest possible capacity for the gage, and cars are made to carry the maximum load that can be safely conveyed on two four-wheel trucks, the cost of transportation will be reduced, but not to a radical extent. It is believed in some quarters that the bottom cost has nearly been reached unless some revolutionary change is made in the track and motive power.

One of the most curious facts met with in railroad history is the influences by which certain track gages were established. The setting of the gage likely to prove most convenient for the business to be done is an engineering problem which ought to have received careful study and profound calculation. Instead of that, the gage was generally decided by some whim. In 1840 there were thirty-three separate railway companies in Great Britain, with 1,552 miles of track, and they had five different gages, ranging from 4 feet 8½ inches to 7 feet—the narrowest gage having more mileage than all the others. The former was George Stephenson's gage, and it was established in a curious way. The gate openings of the first tramroad Stephenson was connected with were just sufficiently wide to permit wheels extending 5 feet to pass. At that time the flange of the wheel was on the outside. When the Stockton & Darlington Railway was built Stephenson put the wheel flanges inside. The width of the rail head was about 2 inches, so the inside gage was 4 feet 8 inches. When the Liverpool & Manchester Railway was under construction the engineers concluded that it was better to give the wheels plenty of side play to make fast running easy, and they widened the gage ½ inch, making it 4 feet 8½ inches.

The success of the Liverpool & Manchester Railway made George Stephenson a great man, and others were ready to imitate what he had done, so his gage was adopted by most of the British railways. He had locomotive building works that supplied many of our early railroads with engines, and the track gage was generally established to fit the wheels of the engine. The South Carolina track was laid to 5-foot gage, and the tendency in the South was to follow that width, but toward the Ohio River and some other Southern districts 5 feet 6 inches was the favorite gage.

There was more confusion in the North. The roads that began with Stephenson engines had mostly 4-foot 8½-inch gage; but there were to be found gages of 4 feet 9 inches, 4 feet 10 inches, 4 feet 11 inches and 5 feet. Canada had 5 feet 6 inches, and the Erie road 6 feet. The wide gage was adopted for the Erie because the chief engineer said that the grades would be so heavy that enormously large locomotives would be needed to haul the trains and that the narrow gage could not accommodate the size of engines necessary. The president favored the wide gage because he did not wish the road to have facilities for interchange with other roads that might be the means of carrying trade away from New York city.

The J. A. Fay & Egan Co.'s Catalogue.

We have received from J. A. Fay & Egan Company, Cincinnati, a catalogue of their wood-working machinery, which for engraving, printing and binding is one of the finest works we have ever examined. Heretofore it has been the practice of the J. A. Fay Company and of the Egan Company to issue separate catalogues, and this combined work is a new departure and is highly creditable to all concerned in its production. As the company is celebrated for the fine tools which they make, they have adopted the sensible policy of producing a catalogue that would do their handsome tools justice. When the builders of tools issue an inferior catalogue the readers naturally associate the quality of what is for sale with the quality of the means taken to describe it, an expensive mistake which J. A. Fay & Egan Company have been careful to avoid.

The catalogue forms a large book of 440 pages of the largest Master Car Builders' Association standard size 7⅛ x 10 inches, being the same size as RAILWAY AND LOCOMOTIVE ENGINEERING. That great amount of space is filled up with beautiful engravings of wood-working tools and clearly written descriptions, which will make the catalogue an excellent handbook of everything relating to the working of wood. The preparing of this book must have involved a vast amount of thoughtful work, but it will stand for years as a monument to the publishers, showing to the purchasers of wood-working machinery the Mecca where the best appliances they need can be found. It will become a useful reference for every man in the country who needs to use wood-working machinery, and it will be particularly valuable to railroad officials, owing to the interesting information which it contains. We warmly commend its study by master car builders and car foremen, for it contains facts about wood-working machinery not to be found elsewhere. For more information about it, write to J. A. Fay & Egan Company, Cincinnati, Ohio.

Additional Correspondence.

Hot Driving Boxes.

Referring to the subject of hot driving boxes, I believe they are often due to driving springs being too stiff and inelastic. Recently I saw a number of engines weighing 160,000 pounds put in service. Those engines had driving springs with sixteen plates, and caused no trouble with hot driving boxes, also rode very nicely.

Another lot of same class of engine, weighing 163,000 pounds were received; had driving springs with twenty plates, rode very hard, and are constantly causing annoyance with hot boxes.

We know that when, on account of broken spring or hanger, an engine has to be run "blocked up," hot driving boxes usually follow, and it would therefore seem that the nearer one gets to the "blocked up" condition the more likely is he to have hot driving boxes. The writer is also of the opinion that to get the best results, the bearing surface of driving boxes should not be either filed or scraped.

The journals should be turned true, boxes bored to fit, and put together in that condition, preferably smearing the surface of box with thin oil and graphite. If a file or scraper is used, the work is done at right angles to the direction in which the journal moves, the lubricant is scraped off and the metals come in contact, or, in other words, the boxes have to be finished in service back to the same condition they were in when removed from the lathe or boring mill.

Another very common cause of hot driving boxes is insufficient taper to flanges of driving boxes, especially where long bearings are used, causing the weight to be thrown on one end of the bearings on curves or uneven track.

Just a little more care and horse sense in shop practice will prevent a multitude of annoyances on the road.

J. F. Walsh.

Leaking Exhaust Pipes.

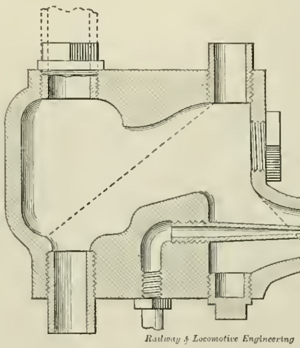
One of the worst things that can happen to stop a locomotive from steaming is a leak in the joint of the exhaust pipe. It does not seem as though this should affect the steaming as much as it does. It is all exhausted steam that has done its work, so the lost steam counts for nothing. I have seen cases where the leak did not puff back against the flues, and yet the leak, while it was hardly discernible, would have its bad effect until repaired. We will assume the outcoming steam did no damage, but the air that was drawn in broke the vacuum. Why would not the air drawn in joint expand and fill stack, thereby compensating for the steam puffing back against the flues? But it does not seem to do that now. When we consider the air being drawn in and expanded, it ought to do something similar to the Smith exhaust, which, if I understand its principle, draws air in a number of places to fill the stack. It also pulls the back pressure from the exhaust side of the piston. Why does not the lead in our exhaust pipe joint help along in this line? Is it because the air drawn in tends to diminish the size of the exhaust, thereby not filling the stack, or something else?

Mr. Barr, the mechanical superintendent of motive power, is going to have a car run over the lines, teaching the theory of combustion, and I think the above question of the leaky exhaust pipe should be explained. Perhaps it will, on the Erie lines.

A. J. O'Hara.

Locomotives on the Wachusett Reservoir.

Was pleased to see your writing in the December number of Railway and Locomotive Engineering. I have been employed on the work since January, 1900, as master mechanic for Nawn & Brock.



SANDER RECENTLY PATENTED BY MASTER MECHANIC WATERS, OF LOUISVILLE & NASHVILLE RAILROAD.

Last year (1900) we had five 16-ton Porter engines, cylinders 10 x 16; six 12-ton Porter engines, cylinders 9 x 14; two 12-ton by the Vulcan Iron Works, Wilkesbarre, Pa.; two 6-ton geared locomotives, cylinders 5½ x 7, gears 3 to 1, driving wheels 23½ inches, built by the J. F. Byers Machine Company, Ravenna, Ohio. I can tell some interesting stories about these little fellows later on.

This year (1901) we had two more of the Vulcan type, making seventeen of our own, and we hired one Ryan & McDonald, of Baltimore, 7 x 14 (she has an interesting history this year) and one 9½ x 14 of same make—nineteen in all.

W. C. Ovenden.

West Boylston, Mass.

Preventing Flange Wear in South America.

Some time ago I saw an enquiry in your paper as to the best means of reducing wear on flanges of wheels on mountain roads, and I thought it might be of interest to let you know what we have to do here. Our engines have a rigid wheelbase of 6 feet 10 inches and a total wheelbase of 14 feet 10 inches. Our curves are 140 feet radius and the gage of the line is 3 feet. Formerly we used to wear through the flanges of our engine wheels in three months, but in 1898 I commenced to use graphite on the inside of the outer rail on curves and have not had to change a tire since. The graphiting is done by our track walkers, who carry long-handled brushes and pots of graphite and water with them. In the dry season we graphite once a day, but when it rains heavily we have to put on more.

With regard to the Chatelier brake, our engines are all fitted with this, and I find I can hold back the engine (36 tons) and from 70 to 80 tons of cars on a 4-per-cent. grade with it without having to use our ordinary brakes. We throw the lever full over and let enough water in underneath the slide valves to cause a big feather at the muffler. The back pressure is from 100 to 120 pounds, and although we have to apply the brake for a distance of 18 miles at a stretch, we have had no trouble with it. Our valves are brass, and I have found it an improvement to cut a zigzag groove in them right around the face. The groove is ¼ inch wide and ⅛ inch deep.

Of course our engines get side play very quickly, but I have managed to minimize this by fitting cast-iron drums on the axles, which drums bear against brass liners pinned on to the axle boxes. Say the hub of the wheel is 11 inches in diameter, then the drum where it bears against the axle box liner is made 11 inches in diameter, too; so that on curves I get double the surface I formerly had to take the side thrust. I may say that these drums answer well here.

A good deal can be done to prevent wear of flanges and brasses by raising the outside rail, but up to now I have not gone beyond 5½ inches super elevation on a curve of 140 feet radius. I think, however, that on a 3-foot gage and a speed of 18 miles an hour 6½ inches will not be too much.

Harry J. Almond,
Administrador, F. C. La Guaira á Caracas.

It is reported that the North Eastern Railway of England likes our 100-ton pressed-steel cars, and is seriously contemplating the purchase of several thousand of them.

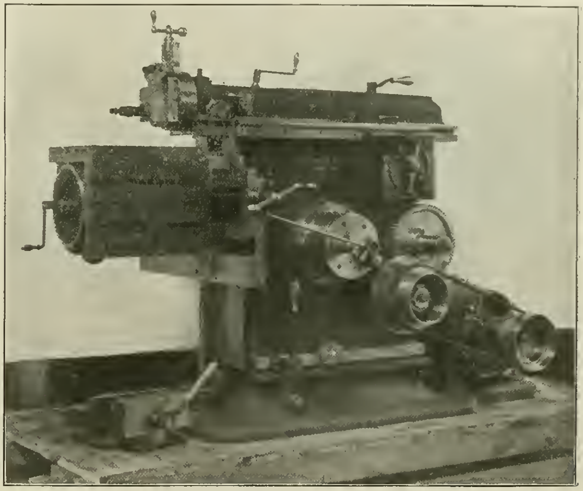
The large increases in the business of the Handy Car Equipment Company have made it necessary for them to remove their office from 1525 Old Colony Building to more extensive quarters in suite 890 of the same building. This company sells the "Handy" box car and the "Snow" car and locomotive replacers.

Potter & Johnston's Heavy Shaper.

The 24-inch universal shaper shown is the latest product of the Potter & Johnston Co., Pawtucket, R. I., and contains several features which commend it to mechanics generally. The one shown is electrically driven by an independent motor.

These machines have power feed in every direction, will feed down or at any angle, and table is also raised and lowered by power. Automatic feed stops are also provided.

Both the ram and ram slide are extra long, which insures accurate planing to the extreme limit of stroke. The cross-slide is very deep and scraped to an accurate bearing. The operator can set the ram at any desired stroke without stopping it, and a graduated dial makes this easy and accurate. This enables him to work to an irregular line.



POTTER & JOHNSTON'S MOTOR-DRIVEN SHAPER.

The cross-slide is mounted on ball bearings and is easily raised or lowered. Graduated collars for fine adjustments are fitted to the feed screws.

The tool slide has a powerful down feed and automatic stop at any angle through an arc of 90 degrees, and has ten changes of feed which can be changed while in motion. The stops to feeds are positive and accurate, enabling the best results to be obtained. The vise provided with these machines is strong and designed to draw the work down when gripped. Those who know the tendency of the ordinary vise to raise and throw work out of true will appreciate this.

The general dimensions are as follows:
Length of stroke—24 inches.
Automatic cross traverse—23 inches.
Vertical adjustment of table—16½ inches
Swivel vise opens—6 inches.
Length of jaws—12 inches.
Revolutions per minute—170.
Net weight of machine with countershaft—3,850 pounds.

Uncle Sam's Mail Boat.

It is not generally known that the United States Government has in New York Harbor a post-office boat, similar in function to the railroad postal car. This boat, the "Postmaster General," meets the incoming ocean liners in the lower bay at Quarantine, and takes from them the mail for this country, loading it in pouches on to the decks of the "Postmaster General." As soon as the mail is loaded, the postal boat hurries to its dock in New York city, where it is met by a large number of government mail wagons, which receive the bags of mail and distribute them to the General Post Office, the sub-stations and the railroads direct. By these methods the most rapid movement of the mail is had, each sub-station and the railroads getting their portions without delay and without the mail having to go through the regular post office. In this way the movement of the mail is so facilitated that nearly always the mail brought up the Bay by the postal boat is in the sub-stations, and frequently on the railroad trains, hurrying out of New York city, before the ocean liner reaches its New York dock. This scheme was originated by Postmaster Van Cott of the New York City Post Office, and is decidedly successful.

"California Limited" is the name of a very pretty illustrated folder sent out by the passenger department of the Santa Fé route. People in the East having ambition to visit the beautiful scenes between Chicago and California ought to send for this folder.

An Improved Die Head.

The Acme Machinery Company, Cleveland, Ohio, are much interested in the following letter from the general foreman of a Western railroad:

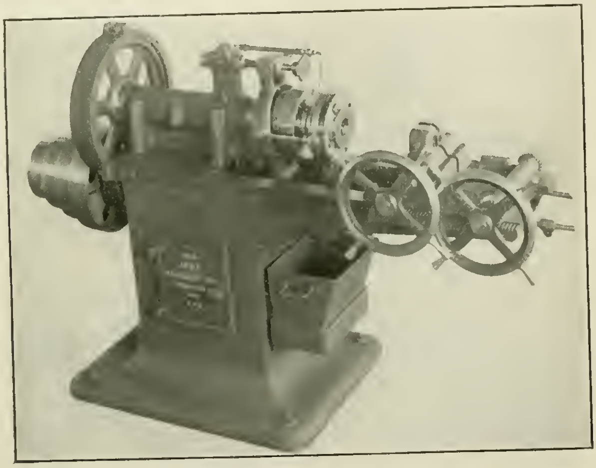
"We have in our shop one of your Triple Head Acme Bolt Cutters. I have made an improvement on this machine for cutting staybolts for new fireboxes where the old outside sheets are left on the boiler. This makes the staybolts larger on one end than the other on account of tapping the old holes in the old outside sheets larger.

"This improvement consists in a tandem die-head which is made to take position in front of the regular die-head. I have made it so that both sets of dies open automatically at the same time. When cutting staybolts of different lengths the distance between the two die-heads can be adjusted to suit. The lead screw on the machine can be used just the same to control the pitch. The die-head can be applied to any of your single, double or triple bolt cutters.

"We find this tandem die-head a most valuable tool for our repair shop. On our small 17-inch engines we average from 200 to 500 staybolts with one end larger than the other when applying a new firebox. To thread these bolts on a lathe, it takes four lathes from three to five days. With the tandem die-head I can do the same work in ten hours at a cost of about 70 cents."

They write: "It seems to us that this short matter-of-fact letter from this hustling general foreman wherein he tells of substituting the work of one machine for ten hours for the work of one lathe from twelve to twenty days at an outlay for tools of perhaps $75 tells the secret of American superiority in manufacturing better than volumes of theorizing could."

They at once made arrangements to build this tandem die-head, believing that every railroad shop could find profitable use for at least one of them, and they can now supply them as needed.



TANDEM DIES ON ACME BOLT CUTTER.

Merwarth Metallic Gaskets.

A gasket is one of the small things which receive but little attention and yet often assume large proportions when they fail at inopportune times.

Copper wire has probably been used for this purpose ever since steam engineering began, and gives good service when rightly used. An improvement on this, however, is found in the Merwarth gasket, which is now being used on many steam plants and in marine service.

This consists of a ring of composition metal inside a copper retaining ring. The composition ring makes the joint, flowing into inequalities under pressure even better than copper, and the copper prevents its spreading outwardly.

These are made in all sizes and shapes where gaskets are used, from small pipe unions up to 108-inch low-pressure cylinders for marine work, as well as in convenient form for steam chests. These are giving good satisfaction and are much more convenient than the old method. They are made by the Merwarth Metallic Gasket Company, 107 Liberty street, New York.

The New York Central people are carefully inspecting their car yards to see that piping for conveying compressed air is installed so that every car may be reached. The intention is to find out the condition of the air brakes on every car that enters a yard and to hold it for repairs if necessary.

Legal Decisions in Air Brake Patent Suits.

Recently two decisions have been handed down by the courts in infringement suits instituted by the Westinghouse Air-Brake Company against the New York Air-Brake Company. The first was for infringement of the pressure retaining valve patents by the New York Air-Brake Company, and the decision of the court is that these patents have not been infringed, thereby granting the New York Air-Brake Company the right to manufacture and sell the pressure retaining valve as it has done heretofore.

The second and more important decision is the one against the New York Air-Brake Company for infringement of brake valve patents. Stripped of legal terms and technical verbiage, the decision substantially means that the New York Air-Brake Company has infringed the equalizing discharge valve patents of the Westinghouse Air-Brake Company in the manufacture and sale of their engineers' equalizing discharge valve, commonly known as the Vaughan-McKee valve. The court decided that the equalizing discharge valve was the first real effective brake valve for operating brakes on long trains, and was patented by Westinghouse and Moore about twelve years ago. The Vaughan-McKee valve was held to be a clear infringement of these patents, and the New York Air-Brake Company has therefore been enjoined from further manufacture and sale of the Vaughan-McKee engineers' valve. The court's decision also grants the Westinghouse Air-Brake Company an accounting for profits and damages arising from the sale of the Vaughan-McKee brake valve by the New York Air-Brake Company.

The Red Flag.

The red button and the red flag have been the emblem of labor and revolution for more than 3,000 years, says the New York *Post*. In the ancient world the favorite colors of the aristocracy were white and azure blue, while red was plebeian. Minerva and Ceres, the goddesses of labor and agriculture, were always represented as dressed in flaming red, and the banners of the Greek and Roman trade unions were of the same color. The red flag nowhere in antiquity meant ferocity and slaughter, but rather typified the fact that all men, whether slaves or masters, had in their veins the same blood and in their nature the same humanity.

But in the frequent servile wars of Italy and Greece the red flag gradually became the emblem not of labor, but of revolt. At one time when the rebellious slaves and gladiators under Spartacus defeated three Roman armies the red flag was on the point of supplanting the eagle in the imperial city itself. It is related that the labor soldiers were so fanatically devoted to their flag that it was the custom of their generals when in battle to hurl it far into the enemy's ranks and so compel its devotees to rush forward and recover it.

Emery Wheels.

An emery wheel probably does more work and has less care taken of it than any tool of its size in the shop. Made of fine particles of emery, corundum or carborundum, which are held together by a bond of some kind and baked at a high temperature, it becomes a revolving tool of many cutting edges. In some makes the bond is also of a material having abrasive properties, which is a valuable feature.

Emery wheels are usually considered very brittle institutions, but that this is not necessarily the case is shown by the elastic wheels of the Norton Emery Wheel Company. These are very thin and are often used in cutting off small, hard stock.

A few years ago we heard of many more wheels bursting than we do now. The strain on a wheel at high speed is considerable and it is not advisable to run a wheel faster than builders recommend. It is to their interest to advocate the fastest speed which is safe as the wheels do better work. A surface speed of 5,000 feet a minute gives a strain of 75 pounds per square inch to the wheel, and as this increases as the square of the speed the strain comes up very rapidly. At 10,000 revolutions this would be 4 times 75 or 300 pounds per square inch, which is more than most wheels will stand. Keep them at about 5,000 feet, or nearly a mile a minute, and you get good results.

The method of mounting has much to do with the breaking of emery wheels and a few suggestions are in order.

Never crowd an emery wheel on the arbor. It should always be an easy fit, so that if the arbor expands from heating of bearings, it will not burst the wheel.

Always use a good-sized flange—at least one-third the diameter of wheel, and half is better. The side next to wheel should be concave—never straight or convex. A concave flange grips the wheel firmly nearer the outside and drives better as well as tending to prevent breakage. Some mount wheels with only a small nut and possibly a washer under it. This practice is liable to break wheels.

Grinding machines should be heavy and bolted to the foundation. Cast iron is cheap and it pays to use it here, as a heavy machine does better grinding.

Keep your rests in good order if you use them. They should be kept close to wheel, as probably more wheels are broken by work getting caught between wheel and rest than in any other way. Caliper rests are perhaps the best, as they can be kept close to the sides of the wheel.

Don't let the bearings get too hot—oil them often enough to prevent this—for, as before mentioned, this sometimes bursts wheels.

When you order wheels, tell the maker

just what work you want them for. If there is any reason why you cannot run them at the recommended speed, better mention that, too. If you have a piece of a wheel which has given good results, it isn't a bad plan to send it to the maker. Then he can send you another wheel just like it.

The speed of wheels is important and affects their work very materially. About 5,000 feet a minute is recommended, as before stated, and this should be maintained as the wheel wears down. This reqnires a variable speed countershaft, or, if a number of grinders are used, they can be run at different speeds and the faster ones use wheels worn down by the first machines. The table shows the revolutions required to give the different surface speeds noted. It is taken from the latest catalogue of the Norton Emery Wheel Company and should prove useful. If a wheel does not work just as you wish, try changing its speed; if this doesn't help it, notify the makers. Should it glaze or fill, it may indicate either that it is too hard or that it is running too fast.

Keep wheels true, both for better work and longer life of wheels. A little truing each day or so will save taking off a much larger amount a little later.

TABLE OF EMERY WHEEL SPEEDS.

Diam. Wheel inch.	Rev. Per Minute for Surface Speed. of 4,000 Ft.	of 5,000 Ft.	of 6,000 Ft.
1	15,279	19,099	22,918
2	7,639	9,549	11,459
3	5,093	6,366	7,639
4	3,820	4,775	5,730
5	3,056	3,820	4,584
6	2,546	3,183	3,820
7	2,183	2,728	3,274
8	1,910	2,387	2,865
10	1,528	1,910	2,292
12	1,273	1,592	1,910
14	1,091	1,364	1,637
16	955	1,194	1,432
18	849	1,061	1,273
20	764	955	1,146
22	694	868	1,042
24	637	796	955
26	586	733	879
28	546	683	819
30	509	637	764
32	477	596	716
34	449	561	674
36	424	531	637
38	402	503	603
40	382	478	573
42	364	455	546
44	347	434	521
46	332	415	498
48	318	397	477
50	306	383	459
52	294	369	441
54	283	354	425
56	273	341	410
58	264	330	396
60	255	319	383

Above table designates number of revolutions per minute for specified diameters of wheels, to cause them to run at the respective periphery rates of 4,000, 5,000 and 6,000 feet per minute.

The medium of 5,000 feet is usually employed in ordinary work, but in special cases it is sometimes desirable to run them at a lower or higher rate, according to requirements.

The stress on the wheel at 4,000 feet periphery speed per minute is 48 pounds per square inch; at 5,000 feet, 75 pounds; at 6,000 feet, 108 pounds.

Steam Engine Scores a Point.

The steam locomotive has scored a point on the electric motor, its rival in the transportation field and opponent in the lively fight now in progress on the Brooklyn Elevated Railroad; and, as a result, the loyal adherents of the steam engine may mark up another good point in their argument for the retention of their favorite. This is how it happened.

The recent sleet storm in New York city covered the rails of the Elevated roads with a film of ice which prevented the electric conducting shoes of the motor cars from taking current from the third rail; hence the motors refused to "mote" until the insulating film of ice had been removed and effective contact restored. A knife-edge device was employed to precede the shoe and shave the film of ice from the third rail. A fluted roller, intended to break up the film was also tried, but, like its predecessor, failed to succor the motor as was expected. The sleet storm thus put the electric motor out of business for the time being and recalled the steam engine which could crack its own ice, until such time as the insulating film could be removed from the third rail.

As the recalling to service of the steam locomotive in this sleet storm was wholly due to the failure to get effective contact for the conducting shoe on the third rail, which supplies current to the motors, we may expect that some ingenious device for effecting the desired result may be forthcoming soon. It may therefore appear proper for the loyal adherents of the good old time Elevated steam locomotive to scratch up a point in its favor; but the wise ones will refrain from mistaking this as an occasion for cutting a deep and decisive notch in their gun stocks in memoriam of the electric motor.

The Pullman Company have just finished and delivered to the Louisville & Nashville Railroad Company three elegant dining cars equipped with the "Axle Light" system of the Consolidated Railway Electric Lighting & Equipment Company. No auxiliary light has been provided in these cars. One of these cars will run between Cincinnati and Louisville and two between Birmingham and New Orleans.

The Government of India are arranging to train soldiers to perform the duties of railway men. A great part of the railway servants of India belong to a union for the protection of their interests, and this union does not take kindly to the soldier-railway-man idea. The men think that the red coats would be employed to take the place of strikers were a disagreement with the railway managements to result in a strike. The government have unofficially intimated that the intention was to use the soldiers merely in case of war, but the railway men are by no means reassured that interference with their rights is not contemplated.

The Vertical Milling Machine in a Railroad Shop.

Shopmen who are not familiar with the vertical milling machine and who always think of the horizontal type when a milling machine is mentioned will be interested in the accompanying illustrations, which show the finishing of a connecting rod brass without the use of special cutters. In Fig. 1 is shown a number of rod brasses (five) clamped to the milling machine table and being faced by an inserted tooth mill. The rate of feed is 7 inches per minute, and a mill of this type insures a good surface when used in a rigid machine. The work is so clamped that changes can be readily made so as to finish the other surfaces.

In Fig. 2 another inserted tooth cutter is used, and the sides of the lower flanges are finished at the rate of 3½ inches per minute. The change of cutters is a simple matter. The bottom of the recess is finished by an inserted tooth cutter in two cuts on each side, both cuts being made at the rate of 14 inches per minute. The tops of the flanges are finished at the same rate, but in separate cuts. The pieces are then loosened and re-clamped, as shown in Fig. 4. This finishes the sides of the brasses with the same mill as was used in the first operation, but owing to the larger amount of surfaces being milled, the rate of feed is somewhat slower than before. They are then reversed and the other side finished with the same mill. If it is desired to surface a box and leave a projection near the pin, this can be done as shown in Fig. 5. In this case the two halves are clamped together in the center of the rotary table, and the round-nosed mill is used, which finishes the face and leaves a fillet around the projecting surface.

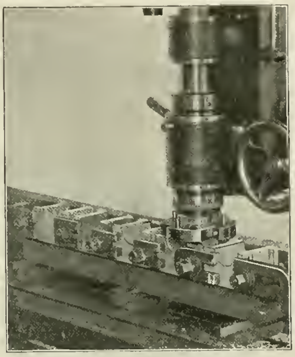


FIG. 1. FACING ROD BRASSES.

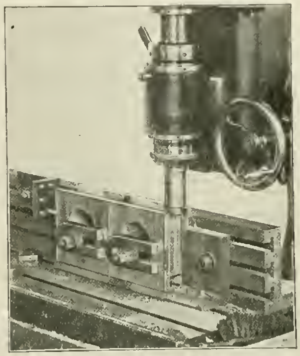


FIG. 3. MILLING BOTTOM OF RECESS.

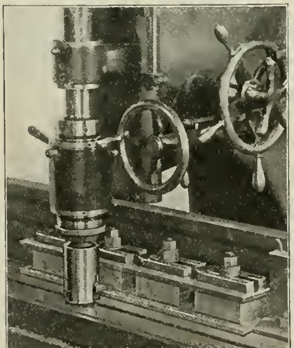


FIG. 2. FINISHING LOWER FLANGES.

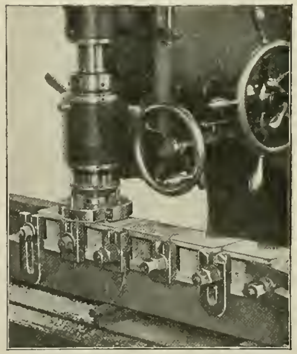


FIG. 4. MILLING SIDES OF BRASSES.

These illustrations are from a No. 6 Becker-Brainard vertical milling machine in the shops of the Boston & Maine Railroad at Concord, N. H. This is an object lesson in the use of the vertical milling machine which it will pay any railroad shop man to think over carefully.

A curious spectacle on a through line lately was a small 15 x 24 engine double-heading a heavy express engine with a train well within its power. The big engine had blown off its whistle, and the small one was taken along to do the whistling. It could toot as loud as the big one.

American Route vs. Suez Canal.

The British Government has abandoned the Suez Canal route for its Australian mails, in favor of the American route. The Suez route required the mails to be carried from Australia, through the Suez Canal, thence by rail to London. The American route brings the mails from Sydney to Honolulu, thence to San Francisco *via* the Oceanic steamship line. The trip across the continent is made by fast train, connecting at New York with the Cunard steamship line, which finishes the trip by depositing the mail in London. The old Suez route was exceedingly hot and oppressive, inasmuch as the greater part of it was parallel to and very close to the equator until after the Suez Canal had been passed through, making traveling by this route disagreeable during the hot seasons of the year. The American route is nearly direct north from Sydney to Honolulu, the equator having been crossed in the meantime, and the continuation of the ocean trip to San Francisco being a very delightful one. From San Francisco to London the remainder of the trip lies in the temperate zone, making traveling very agreeable. While the American route places the Australian mail in London five days quicker than *via* the Suez Canal route, a further significance is in the fact that passenger travel will probably follow the mail. This is only to be supposed when we consider the much greater comfort experienced in traversing the new route as compared with the old.

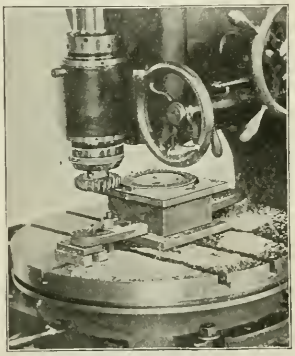
Man, Gun, Cowcatcher and Bull.

Mr. William Watlington is a hunter bold and he searches for game in the places where animals are most likely to be found. The story was told in a court of justice that Mr. Watlington strolled upon a railroad track in his quest for game. There was an embankment at the place and on each side was a ditch with water therein. Mr. Watlington was standing between the embankment and one of these ditches on the north side of the track with his gun on his right shoulder. On the other side of the track were a number of cattle nipping grass, which Mr. Watlington could not see. A train came in sight. A few seconds before the train passed these cattle commenced to straggle across the track to the side on which Mr. Watlington was standing. The bovines all got safely across except one small Jersey bull, which was struck by the cow-catcher and hurled away with terrible velocity.

As misfortune and luck both would have it, the animal struck Mr. Watlington about amidships, knocked him down into the ditch, and landed on top of him. The bull was stunned, and struggled, but could not get up, and the water was drowning both man and beast. The engineer was watching the cattle and had not seen Mr. Watlington. When the fireman told him what had happened he stopped the train, hurried back, and got there in time to pull Watlington and the bovine out of the ditch before they were drowned

Striking Mr. Watlington and knocking him into the water saved the life of the bull, and the water prevented the blow by the bull from killing Watlington. Further examination showed that when the bull struck Mr. Watlington the shock knocked the gun some distance away, and when it struck the ground it was discharged and killed one of the cows and wounded another so badly that it had to be killed. The gun was not injured.

On these facts Judge Brown held that the railroad company was not liable in damages to Mr. Watlington. Since the trial the owner of the two cows has sued Mr. Watlington and recovered $100 in full of damages for their killing. The only source of consolation left to Mr. Watlington is the gun which came through the fray without damage and continues to give the owner amusement, but not on the railroad track.



VERTICAL MILLING MACHINE IN RAILROAD SHOP, LEAVING A FILLET ON SIDE.

The Republic & Grand Forks Railway, of British Columbia, have placed an order with F. M. Hicks, of the Hicks Locomotive & Car Works for two modern coaches and a passenger engine. One of the coaches is to be a straight passenger coach and the other a combination coach. These are to be finished in Pullman colors, interior to be oak with flat oil finish, Hale & Kilbourne 26-inch high-back walk-over seats, steel platforms, pantasote curtains and continuous hat racks. The locomotive is to be an eight-wheel, 17 x 24 passenger, with 56-inch wheel centers, "Monitor" injector, Nathan lubricator, air sander, air bell-ringer and a 3,500-gallon tank.

A Valuable Catalogue.

Messrs. R. D. Wood & Co., of Philadelphia, have just issued a very interesting book—for it is more than a catalogue—on "Water and Gas Works Appliances and Pumping Machinery." A large-size book

of about 175 pages, it contains a large amount of valuable information, such as commercial values of diameters of cast-iron pipe, which shows the importance and economy of laying large pipes. The chapter on Electrolysis of Cast-Iron Pipe is particularly interesting and fully illustrated.

Steam Pumping Engines and Centrifugal Pumps are also of value and contain several charts and much data that will be kept for reference. It is one of the best books on this subject that we know of, and those who can secure a copy will be glad to find a place for it in their engineering library.

Abolish Mileage Charges for Cars.

When railroad companies are suffering from shortness of freight cars there is always an agitation to find out where all the cars are. The vicious system in vogue of paying for the use of cars according to the mileage they make is responsible in a great measure for the periodical car famines. A great part of the cars which ought to be kept moving carrying freight are held in side tracks, acting as storehouses for the owners of the freight they contain. If the rational system of charging by the day for cars that are off their owners' lines was adopted and rigidly enforced, there would be fewer complaints about shortness of cars.

The presidents of several of the most prominent Eastern railways have been considering the advisability of charging for the use of cars on the per diem system, and it will be a just move to put it in practice. This is a railway reform of far-reaching consequences and has been agitated for many years.

For ten years sporadic attempts have been made to secure the general assent to the plan by the railroads of the country necessary to secure the success of the system, but without results. Some months ago a number of influential railway officials took up the question, and they have now secured the assent of so many important lines, in the East and the West, to the adoption of the per diem plan, that announcement shortly will be made by a long list of companies of the abandonment of the old system of mileage payments for the use of cars and the substitution in its place of the per diem plan.

The interests that have always opposed the per diem system are railroad companies which depend upon their connecting lines to supply them with the cars required to transport their freight. These interests have always found it cheaper to use their neighbors' cars than to purchase rolling equipment for themselves. If the presidents of the Eastern lines adopt the per diem system and enforce it rigidly, there will be some roads in the car-building market in a hurry, and they will not be able to purchase cars half so fast as they need them.

There has always been a great deal of looseness in accounting for the cars on the mileage plan that are absent from their owners' lines. A car is loaded for a certain place and very often nothing more is heard of it until it returns to the home road. We have known cases where cars belonging to foreign lines were put into construction work and kept there a whole season, while the owners were not able to tell where they had gone. Sometimes they would be discovered by lost-car searchers and ordered home, and in other cases they would be retained until the road holding them had no longer any use for them. We never knew of people who stole cars in this way for a season being compelled to pay the fair rent of the cars, but we have repeatedly heard of the men who were morally thieves sending in charges for repairing the cars. This may sound like stupendous assurance; but men who steal cars are not sticklers about such a trifling matter as honesty. Per diem charges would hit these people on a sore spot called the purse.

Harding's Exhaust Mechanism.

An improvement in locomotive draft appliances has been patented by Russell Harding, of St. Louis, Mo. It consists of a peculiar form of exhaust pipe and attachments thereto. The lower part of the exhaust pipe is globular, and on the top of it is a movable sleeve which conveys the exhaust steam into a petticoat pipe that connects with the base of the smokestack. A lever connects with the sleeve, by which it can be raised or lowered. Moving the sleeve provides the means for regulating the draft through the tubes. The petticoat pipe can be raised or lowered, providing a second means of regulating the draft. The invention looks as if it was a decided improvement on existing draft appliances.

A railroad fireman who wants to know the why and wherefore of things writes as follows to the railroad editor of the Pittsburgh *Post:* "I am firing on a hog and am in doubt as to the location of the 'hog's head.' The forward end of the 'hog' is called the front end, and I never yet heard of a case where there was any animal or any other thing that has its head where its tail should be. In this case I think the hog's head is at the tail end. You know the smokebox of a locomotive is called the front end and the cab end is called the boilerhead. Now, then, here is a case of a double-header, sure, with a front end in front and a head behind. However, I would call attention to the fact that the engineer I am firing for is a 'hog.' This would make two hogs' heads in the rear and one in front, or, in other words, a three-headed hog, who can't tell his front end from his tail end. You see where I am at. I hope you will try to relieve my mind and tell me which is the head end of a hog locomotive."

Too Busy to Whip the Man.

During the Carnival week, says the Wichita *Eagle*, while a hundred people were waiting for tickets, a man with a pad and pencil approached E. E. Bleckley at the Missouri Pacific ticket office and wrote this:

"When does the train to Hutchinson go?"

Mr. Bleckley took the pencil and wrote the answer:

"Five twenty."

"Does it go in two sections?" wrote the man.

"Yes," Bleckley wrote back.

"Does it carry a chair car?" the man wrote again.

"Yes," Bleckley wrote again.

"Can I get out later this evening?" the man wrote once more.

Mr. Bleckley was getting irritated. The crowd had been blocked by this deaf and dumb man and the waiting-room was becoming crowded. But Mr. Bleckley hated to show his impatience to the unfortunate man and wrote back:

"Yes."

"How long does it take to run to Hutchinson?" the man wrote again.

"An hour and a half," scribbled Bleckley.

The man backed off a few feet and smiled and then said, pleasantly:

"I am much obliged to you."

If Bleckley hadn't been so busy he would have gone out and licked the wag within an inch of his life.

Automatic Signalling on the Lehigh Valley.

During the last month the Lehigh Valley Railroad has finished equipping its main line between Jersey City and Buffalo with automatic electric signals, making it the only trunk line thus far having a complete automatic block system between these points. The Hall system of automatic track circuit, normal danger, with both the disc and semaphore types, are used.

The disc type consists of a case or, as it is more commonly called, a "banjo," mounted on a mast, having within its walls separate openings for the display of both day and night signals. The signal disk stands normally at danger, being brought to that position by gravity, and is drawn to the safety position by means of an electro-magnet.

The semaphore type consists of a hollow pipe mounted on an iron box about 6 feet high and 22 inches square. Within this box is placed the mechanism for operating the signals, which is driven by a one-sixth horse-power motor. To this mechanism are attached the up and down rods, which are placed on the inside of the mast, which are in turn attached to semaphore shafts at the top.

Each mast displays two signals, a home and a distant signal, to show to an approaching train if the blocks ahead are clear or occupied.

All switches in the main track and all switches leading to the main track are taken into the signal circuit, and are provided with switch instruments connected to the switch point in such a manner that the opening of any switch will hold the home signal of the block in which the switch is located at stop, and the corresponding distant signal at caution, until the switch is again closed.

The opening of a switch at either end of a main track crossover holds the signals in both directions at stop in the same manner.

All switches are provided with visible indicators, and when located in any particular block display a red disc from the time a train enters the second block back until it has passed out of the block in which the indicators are located.

The main line between Jersey City and Buffalo is divided into 366 eastbound and 379 westbound blocks, or a total of 745 blocks in both directions, 516 being equipped with the disc type and the rest with the semaphore. There are 1,032 disc signals and 458 semaphore on the main line. This protects 133 crossovers in the main line, 49 crossovers leading to main line, 375 sidings, inlets and outlets, on the main line, 17 crossovers on branches and 14 sidings on branches.

One of the chief objections to coil springs has been their unsteadiness or tendency to "dance," as it is often called. This feature has led to their abandonment for engine and tender trucks by some roads. The McCord spring dampener obviates this defect and acts somewhat similar to the Westinghouse friction draft gear. Its use on cars makes it a big saving of springs, prevents rocking of cars and gives more uniform draw-bar height. These dampeners are made by McCord & Co., Chicago.

We have on our desk in the shape of a diamond stack a match-holder sent to us as a Christmas present by Mr. John J. Driscoll, master mechanic of the Catskill Mountain Railway. The holder was made from a mud-sill which was used in the construction of the road early in the 30's, and forms an interesting relic. It was dug up after being buried in the ground about fifty years, and the wood is in excellent preservation.

One of our exchanges says that many of the "G-4 A" freight moguls on the Pennsylvania lines appear to have more fire in the smokebox in front than they have in firebox. When these engines get well warmed up to business, it is said to be difficult to determine which end is the hotter. Those who are responsible for keeping up steam regret that the heat of the front end cannot be utilized to boil the water.

Soldering Fluxes.

Good soldering is impossible without a good flux. Everyone who has handled a soldering iron knows this, but knowledge of the fact does not imply an understanding of its causes. The chemical action known as oxidization, the combination of metal with the oxygen of the air brings to the surface of the metal a more or less dense film, which prevents the solder from adhering to the body of the metal. Thus rust is oxide of iron, and to try to weld two pieces of iron which are coated with rust is to attempt the impossible. Welding and soldering are mechanical unions governed by the same broad principle; therefore our comparison is legitimate. A true flux has the power of removing this oxide, and thereby of allowing the solder to unite with the surfaces to be joined. There are numerous fluxes, the most common being chloride of zinc in solution. This has several advantages and some disadvantages. It is easily made, is cheap, and does the work well; but, on the other hand, its use, unless more carefully manufactured than is commonly the case, is attended with several objectionable features. It is made by allowing zinc or spelter to dissolve in muriatic acid, otherwise known as hydrochloric acid or spirits of salt. As much zinc should be used as the acid will take up. As hydrogen is evolved at a rapid rate in the process, especially if a large quantity is being made, reasonable precautions against fire or explosion are necessary. The fumes of the muriatic acid should on no account be allowed to come in contact with bright metals, particularly tin, or corrosion is certain to follow. Thus stocks of manufactured tinware should not be kept in a room or workshop where the process of soldering with killed spirit is performed. In addition to the objectionable fumes of "reduced spirit," as it is called, this flux usually leaves stains around the soldered joint, unless scrupulous care is exercised thoroughly to remove the fluid after soldering. Most of the soldering fluids on the market have as their base chloride of zinc, which, in combination with some other salt or salts, gives them their alleged or real value.

Hydrochloric acid alone is sometimes used as a flux, but only for zinc or galvanized iron. Soldering with undiluted spirit of salt is a most undesirable job, and a swollen nose and inflamed eyes are a frequent result of the work. Its use is the less excusable now that preparations can be purchased which do the work well without the attending disadvantages.

Borax is a flux which is used in hard soldering or brazing. Resin then comes up for consideration. After chloride of zinc it is the most common flux. It is used almost exclusively for electrical work, because corrosion of the copper follows when the soldered joints are made with zinc chloride. Indeed, resin is usually specified in electrical contract work, and its sole use insisted upon. There is small reason to wonder at this, in view of the past misuse of zinc chloride, which, by its easier application, is preferred to resin by the artisan.

Other fluxes are gallipoli oil, which is used by pewterers, and this is also the best for fusible solders containing bismuth, Venice turpentine used by silversmiths, mutton fat used by plumbers, and sal ammoniac, which finds its chief adoption for soldering copper and for gold, upon which it has a toughening effect. For aluminum the flux recommended is lard oil.—*The Ironmonger.*

Mr. James Buchanan, who was for many years master mechanic of the New York Central Railroad, in charge of the West Albany repair shops, has been appointed general superintendent of the Richmond shops controlled by the American Locomotive Company.

The "Soo Line" people are experimenting with the Day-Kincaid stoker and have applied it to engine "600," which is one of the largest compound locomotives in the world. The tests of the stoker are being conducted by Mr. J. R. Luckey, engineer of tests of the Day-Kincaid Stoker Company, and are coming out very well.

"Negative lead" is a common expression in regard to valve setting, which is a ridiculous paradox. Everybody knows that retarded opening or setting the valve with lap instead of lead is meant, but the engineering world ought to find a word which would correctly express what is meant. Negative lead is as sensible as going backward ahead, or descending upwards. It ought not to be tolerated.

In spite of all the talk we have heard lately about British locomotive builders losing their foreign business, lately published statistics indicate that they are still sending a good many locomotives abroad. The value of the export of locomotives for September last was $1,069,755, as compared with exports to the value of $484,075 having been made the previous September.

Mr. Clarence P. Day, who was for several years connected with the advertising department of RAILWAY AND LOCOMOTIVE ENGINEERING, has started a business in New York as an advertising counsellor. The line of business which he expects to pursue is advising advertisers as to how they can best make their advertisements effective, the designing of attractive advertisements and giving advice about the advertising mediums most likely to produce good results. There is a good field for Mr. Day to labor on, and we hope his work may reap an abundant harvest.

The Norton Emery Wheel Company, Worcester, Mass., have issued a very complete catalogue of 164 pages showing their various sizes and shapes of emery wheels and grinding machinery. It will astonish almost any user of wheels to know that such a large variety is kept in stock and the information concerning wheels given in the front of the book is of great value to practical men.

The "Four-Track News" for December, published by the New York Central passenger department, gives notes of travel describing the attraction of various places along the New York Central. Besides having numerous pretty pictures, it contains a great deal of interesting reading matter that people of the Empire State will find very attractive.

The coming season promises to be a very active one with the Pennsylvania Railroad Company. A wonderful amount of work will be done on the main line, eliminating curves and reducing grades.

No. 30 "Record of Locomotive Construction," the monthly publication of Baldwin Locomotive Works is devoted to compound locomotives. It contains pictures of the Baldwin Locomotive Works, Vauclain locomotives finished and in parts, among the latter being the perspective sectional view of the cylinders and steam chest which appeared in RAILWAY AND LOCOMOTIVE ENGINEERING last year in connection with F. H. Colvin's articles on "Compound Locomotives." There are other attractive illustrations, among them a piston valve with movable slide. This will be a very useful illustration for the many men who write to us asking questions about piston valves. We hope they will write to the Baldwin Locomotive Works in future.

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Rogers Cross Compound for the Great Northern.

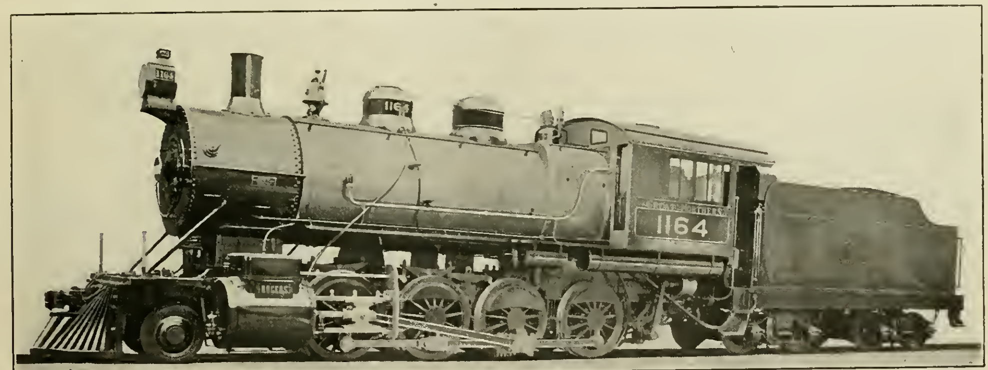
The illustration shows one of the large consolidation engines recently turned out by the Rogers Locomotive Works for the Great Northern Railroad. It is of the two-cylinder compound type, and as the arrangement of the intercepting valve is somewhat different from the other two-cylinder compounds, the details will be of interest. The low-pressure cylinder is on left-hand side, and the by-pass valve shown in the line engraving is located directly behind the nameplate on the cylinder. As will be seen by referring to the detail of this, it consists simply of a casting which connects the ports leading to both ends of the cylinder. The valve *R* is shown in its lower position, which it occupies as soon as steam is shut off and the engine is drifting. This allows the air to pass from one end of the cylinder to the other and avoids the excessive blast on the fire which sometimes occurs in compound engines.

As will be seen, there is a connection *V* which is piped to the high-pressure steam passage. This admits steam under the valve and closes this by-pass whenever steam is being used in the cylinders.

The piston details are shown in the small cut illustrating the low-pressure piston head. The center is of cast steel, carrying a cast-iron bull ring in which are two ¾-inch piston rings, as shown. The high-pressure piston is made in the same manner.

The section cut showing the details gives an idea as to the location of the valve motion and spring rigging. The valve motion has a transmission bar which goes around on driving axle, and is suspended by the link shown. The compound mechanism is located in the arch on the low-pressure side, and the intercepting valve and the reducing valve are both carried in a removable sleeve *W W*. We have shown the small regulating valve, which is controlled from the cab, in this cut, so as to make its connection clear, and the lines from this valve to the different parts of the intercepting mechanism show where the pipes run. The valve *C* in this regulating valve is a round-faced D-valve, which controls the passage of steam through the ports shown. When this admits steam to the chamber *F* through pipe *E*, as when working simple, the intercepting valve *Q* moves to the right as shown, and at the same time the chamber *L* at the extreme right is under no pressure and the valve *J* opens to the right. This allows the exhaust from the high-pressure cylinder to pass out at *Y* over into the exhaust passage of the low-pressure cylinder and out of the stack.

Moving the regulator valve *C* so as to open port *K*, steam passes through the pipe into chamber *L* and forces valve *J* to its seat, as shown. This same movement of the valve *C* allows the pressure in *F* to escape under valve *C* and out of port *N*. The intercepting valve is now moved to the left by exhaust from high pressure, and seats at both ends as shown. This closes the passage from *B* through *H H*, and the high-pressure exhaust then passes into the receiver and to the low-pressure steam chest. The passage *B* goes entirely around the sleeve *W W* and is always receiving steam from *D*, and is also connected through *Z* with the steam passage leading to the high-pressure steam chest. The reducing valve *R* is of the usual differential type, in which the area of the small end corresponds or represents the high-pressure cylinder, while the area of the large end represents the low-pressure. In this case the area of the low-pressure cylinder is 2¼ times that of the high, so that the area of the large end of the reducing valve must be 2¼ times the area of the small end.



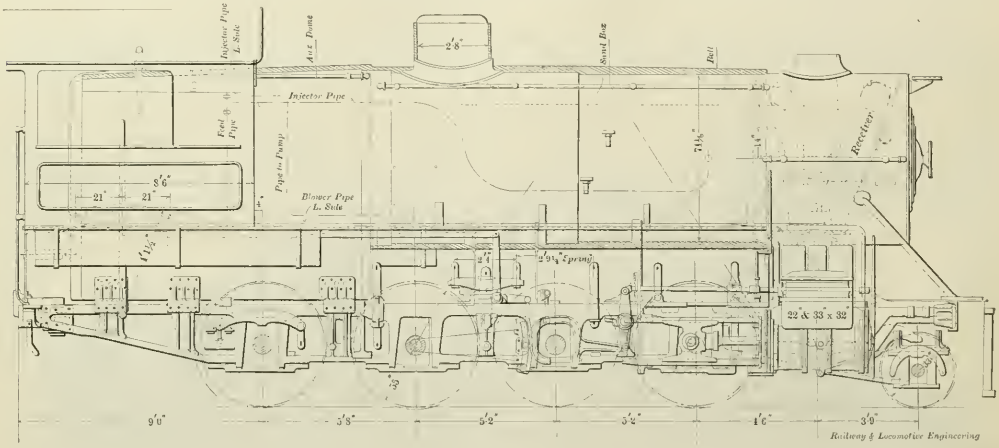
NEW ROGERS COMPOUND FOR GREAT NORTHERN.

In working the engine simple, this valve reduces the pressure of the steam going to the low-pressure cylinder just in proportion to the areas of this valve. This means that if the high-pressure is receiving steam at 170 pounds, the reducing valve will deliver 75.5 pounds pressure to the low-pressure cylinder. This equalizes the work done on both sides. The smaller end of the reducing valve is always opened to the atmosphere through passage *M*, as shown. We have explained this in detail, because we are constantly receiving questions as to the operation of the reducing valve in two-cylinder compounds.

From the following dimensions it will be seen that, while this engine is not "the largest ever built," it is still very heavy

and will exert a drawbar pull of 36,138 pounds at 200 pounds boiler pressure.

High-pressure cylinder—22 x 32 inches.
Low-pressure cylinder—33 x 32 inches.
Diameter of driving wheels—57 inches.
Diameter of truck wheels—33 inches.
Weight on drivers—179,000 pounds.
Weight on truck—15,000 pounds.
Total weight—194,000 pounds.
Driving wheel-base—16 feet.
Total wheel-base—24 feet 3 inches.
Boiler—Belpaire type.
Diameter smallest ring—74¼ inches.
Firebox—Length, 123 inches; width at grate, 42 inches; height, front, 77 inches; height, back, 73 inches.
Tubes—340 2-inch, 14 feet 8 inches long.
Heating surface—Tubes, 2,606 square feet; firebox, 206 square feet; grate, 35.5 square feet.
Frames—Wrought iron, 4½ inches wide.
Guides—Steel, case-hardened, 9 inches wide.
Crossheads—Alligator type, bearing surface, 9 x 24 inches.



ROGERS COMPOUND FOR GREAT NORTHERN.

Driving wheel centers—Cast steel, 44 inches diameter.
Driving boxes—Cast steel.
Driving axles—Forged steel; journals, 9 x 12 inches.
Truck axles—Forged steel; journals, 6 x 12 inches.
Tender:
Tank capacity—6,000 gallons water, 11 tons coal.
Frame—12-inch steel channels.
Trucks—Arch bar type.
Wheels—33-inch Krupp.
Axles—Steel, M. C. B., 100,000 pounds capacity.

Engineer Did Not Know a Piston Was Lost.

In the course of a discussion on locomotives Mr. R. P. C. Sanderson, of the Seaboard Air Line, remarked:

"Some experience which I have had in the West with four-cylinder compound locomotives indicates that the matter of detail design is of the utmost consequence, if the engines are to make maximum mileage and stay out of the roundhouse and shops, and if the running repairs are to be made quickly and cheaply. In the case of one four-cylinder compound engine hauling a passenger train, that came under my notice, the engineer who brought it in reported that the valves were out of square. Examination of the engine showed the valves to be set properly, but the cylinder heads were removed for the purpose of examining the pistons, and it was found that an entire low-pressure piston was missing, and the engine had evidently been running for some time in this condition."

That was a curious case, and to those unacquainted with the working of four-cylinder compounds may seem incredulous, but it was by no means a unique case. We have several times been informed about similar accidents and questions asked about how to detect the defect. Unless the noise is heard when the piston breaks detection is difficult afterwards, for the low-pressure cylinder merely becomes an enlarged exhaust passage. When a four-cylinder compound suddenly begins to exhaust irregularly it is a good plan to open the cylinder cocks. If there is a steady blow through both cylinder cocks of the low-pressure cylinder, an examination of the piston is demanded.

The Midland Railway is the latest English road to apply the compound principle to their fast express engines. They have recently turned out two fine locomotives from their Derby works for the Scotch express. They are evidently of the Webb type, having two high pressure and one low. Four coupled 7-foot wheels, 180 pounds of steam and a 4,800 gallon tank make them good size in every way.

The Expense of Mistakes.

BY F. P. ROESCH.

THIRD PAPER—CYLINDER PACKING.

We will now pass from valves to cylinder packing.

Defective cylinder packing can be easily located when engine is working by watching the position of crosshead when the blow takes place. As a rule, the intensity and continuance of a valve blow is constant, while that of cylinder packing is intermittent or variable.

Cylinder packing blows hardest at the beginning of the stroke. By watching the crosshead and noting its position when the blow takes place, the defective side is easily located. If the loud blow takes place when the right crosshead is at either end of the guides, the fault is in the right side; if when the right crosshead is in center of guides, the blow is in left side. So you see you don't even need to leave your seat to locate it.

The intensity of cylinder packing blows varies because, first, cylinders wear most at the ends and packing that is simply worn will not fit and blow at each end and yet may make a joint in center of cylinder and stop blowing entirely; second, because when piston is at beginning of stroke, it receives the full pressure of steam; as the piston travels back the valve travels ahead cutting off direct steam. Expansion now takes place. As the steam expands the pressure decreases, and with the decrease in pressure in the cylinder the intensity of the packing blow likewise decreases until valve opens to exhaust, when the blow ceases entirely. This takes place before the piston completes the stroke.

By keeping this in mind—that cylinder packing blows most at the beginning of stroke, that the intensity of the blow varies, and that it ceases entirely during a part of the stroke—no trouble should be experienced in locating it correctly.

MISTAKES IN LOCATING POUNDS.

From mistakes in locating blows we pass to mistakes in locating pounds. To keep this article within due bounds we limit ourselves to the two principal pounds, viz., rods and driving boxes.

I was passing through a machine shop some years ago, before solid side rods became in vogue, and I noticed that all side rod keys were being removed, and the holes in straps plugged up on all engines in process of overhauling. I considered this rather strange, as they were not replacing the strap rods with solid ones—simply removing the keys. Upon questioning the superintendent of motive power in regard to it, he expressed himself thus: "Frank, I have as good a set of engineers as you will find anywhere; they get over the road, are economical with supplies, and take good care of their engines, but damn 'em every time they hear a click or a knock about their engines, no matter if it is the pilot bar rattling in the car-head, or a brake-shoe slapping against the tank wheels, down they go with the coal pick, and drive down every rod key they can move! I tried talking to 'em, suspending 'em, in fact everything I could think of, but it didn't do much good; so finally I concluded to take the keys out. Now, if their engines develop a pound, by gad, they've got to locate it."

You may think this superintendent of motive power was inclined to put it rather strong, but just ask the roundhouse man, he will tell you there is truth in his assertion. He will tell you that many men report the brasses in back end of main rod reduced, when they are already tight enough to clamp the pin. The engineer simply makes a mistake in locating the pound—carelessly, perhaps. He does not stop to think that it takes money to take down a back end, caliper pin and brass, find it does not need closing and put it up again. Just a small mistake, but it cost the company a dollar or two.

A MAIN ROD POUND.

There is no occasion to make a mistake in locating a main rod pound. It always takes place at the end of the stroke, but if you want to make sure, place your engine in any position where you can admit steam to both sides of the piston, and have fireman "thump" her.

POUND ON SIDE RODS.

When side rods begin to pound—and side rods will pound at times—find out why. They won't pound as long as you keep the wedges up where they belong, or the engine is in tram.

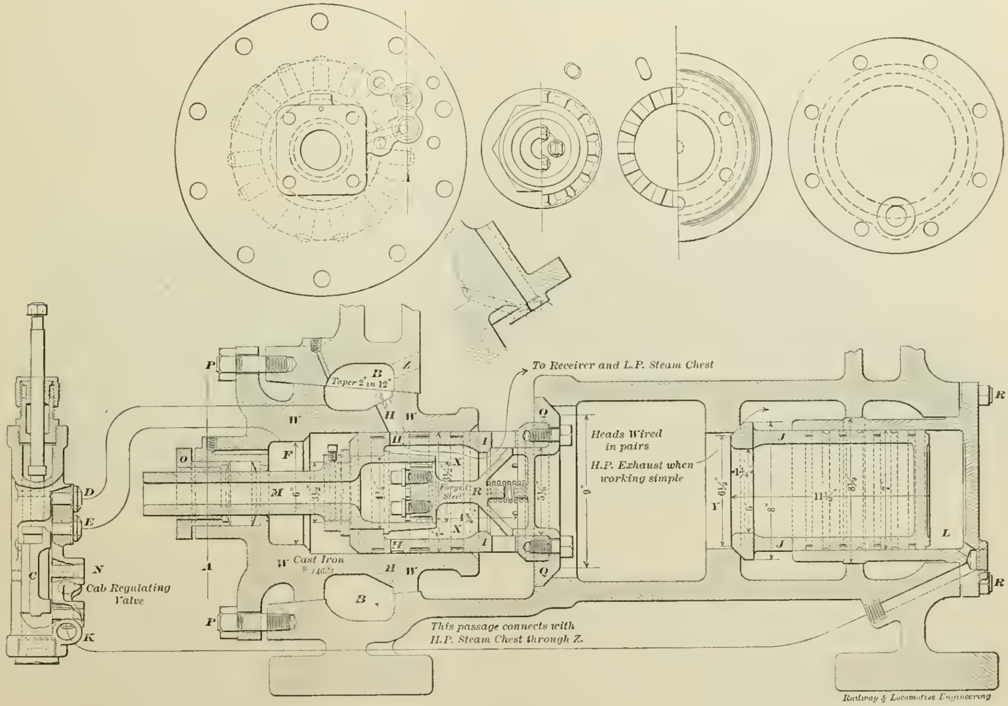
A POUND HARD TO LOCATE.

Not long ago an engineer complained to me about being unable to keep the main connection brasses in shape. He had found it necessary to have them reduced and lined up (strap rod) about once a week for the past three months. The wedges were all up and the roundhouse men had trammed the engine and found her in tram, but still the main connection brasses would pound out every few days.

The trouble was this: He had a loose brass in a main driving box, due to a shim, which had been around brass, working out unnoticed, and on account of the eccentrics he could not see that brass was loose. He made a mistake in not locating the cause of his troubles and having that fixed, instead of constantly reporting the side rods. His mistake probably cost in the neighborhood of $25.

TRYING TO LOCATE A DRIVING BOX POUND.

When trying to locate a driving box pound, such as would knock your side rod brasses out, spot the engine with crank pins on upper quarter on the side you wish to try (with pins on lower quarter the counterbalance is often in the way, so you cannot see box); block the wheels with nuts, and have fireman "thump her." Watch boxes carefully to see if they rock in jaws, between shoe and wedge, or if journal moves back and forth in box. In this position everything in the line of rods or boxes can be tested, provided the fireman does not get tired and quit you before you get through. If he does not, then go after the other side the same way. Sometimes the wedges have not the right taper. This will cause a box to pound, no matter



INTERCEPTING VALVE OF ROGERS COMPOUND FOR GREAT NORTHERN.

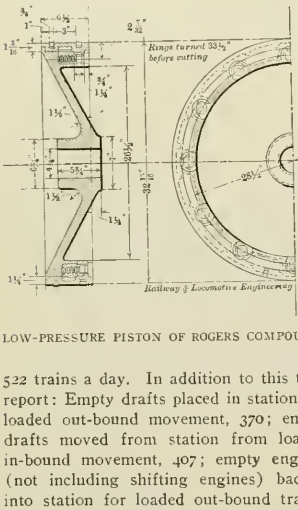
how tight wedges may be set up. On the whole, the average pound is not hard to locate, if you only go at it right.

Some of the Great Railroad Terminals.

The number of tracks and their mileage used in terminal stations, as well as the trains handled per day, are always matters of interest. The new South station in Boston evidently heads the list with twenty-eight tracks on the street level and two loop tracks in subway for future use in handling suburban business. The tracks have a total length of 15 miles and cover 35 acres. The present winter schedule is 758 weekday trains in twenty-four hours, and in the summer of 1901 this was increased to 775.

The Grand Central Station of the New York Central Railroad in New York has twenty tracks in two train sheds, the length of tracks being given as 2.55 miles. They handle, on an average, 550 trains a day.

The Broad Street Station of the Pennsylvania Railroad in Philadelphia has sixteen tracks, with a total length of 2 miles 653 feet. They are handling at present 522 trains a day. In addition to this they report: Empty drafts placed in station for loaded out-bound movement, 370; empty drafts moved from station from loaded in-bound movement, 407; empty engines (not including shifting engines) backed into station for loaded out-bound trains, 405; empty engines (not including shifting engines) backed out of station from loaded in-bound trains, 435. This makes a grand total of car and engine movement of 2,139.



LOW-PRESSURE PISTON OF ROGERS COMPOUND.

Notes From Field Columbian Museum.

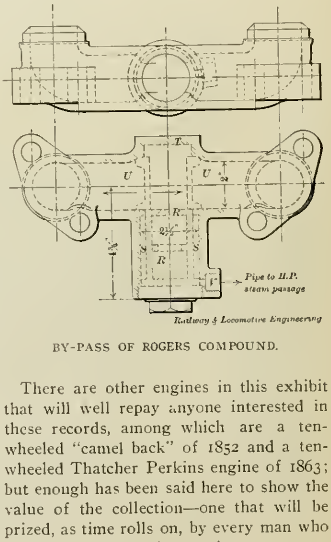
To those who are interested in locomotive engineering, who like to trace the development of that masterpiece of the mechanical engineer—the locomotive, there is no exhibit equal to that of the Field Columbian Museum at Chicago. Railroad posterity will rise up and call blessed the projectors and finishers of the scheme that preserves to us those old landmarks in locomotive design. This exhibit is not a new one—on the contrary, it is practically the one familiar to those who saw the Columbian Exposition in 1893; but there have been additions to the original collection, and as it now stands there is an almost unbroken chain in the chronological order of development of the machine, up to the construction of 1863.

Beginning with the Newton reaction engine, which is simply a large steam reservoir on wheels, depending on the reaction of a jet of steam against atmosphere for its motive power, the best thought of 1680 in this direction is shown, as marked out in the full-size model of the original. Next comes the Cugnot engine of 1767, in which but little improvement is evident in the eighty-seven years between them. After this we find in the Trevithick engine of 1800 some attempts at original design, and this originality further demonstrated in the Oliver Evans engine of 1804, the latter being a sort of a hybrid, since it would propel itself either on land or water. These machines are also full-sized models, as are "Puffing Billy" of 1813 and Peter Cooper's "Tom Thumb" of 1829.

The first faint signs of the locomotive as we know it to-day are evidenced in the full-sized reproduction of Stephenson's "Rocket" of 1829 as the engine appeared at the Rainhill trials, with inclined cylinders and half-cranked axles; also Stephenson's "Mercury" of 1830, with inside cylinders and cranked axles. A full-sized working model of the "Old Ironsides" built in 1832, with inside cylinders, is next in order, and one of the interesting things about this engine is the original nameplate taken from the original engine, on which is cast "M. W. Baldwin, No. 1, Philadelphia." There is a whole lot of history in that old nameplate. Next comes the "Rocket" of 1832, built by Braithwaite, with inside cylinders and cranked axles. This is the original engine exactly as it left active service. After this engine comes the "Sandusky" of 1837, built by Rogers. This engine has outside cylinders with driving boxes outside of the frames. The "Samson," built by Timothy Hackworth in 1838, is also the original engine, and there are some original things about it. The cylinders are placed vertically on each side of boiler, with steam dome immediately between. The engine is six-wheel connected and has a leading truck, and is probably one of the first attempts with more than two coupled drivers. The provision for the comfort of the enginemen, in the shape of two wrought-iron chairs in the place of what is now our seat boxes, is the first thing of the kind in evidence.

The "Albion" of 1839, also the original engine, is a six-wheel connected with inclined cylinders over front drivers, with no truck. This engine also has iron chairs for the engineer and fireman.

The "Mount Clair" of 1845 is a model of a Baltimore & Ohio engine having eight wheels connected, with inside cylinders which are connected to the third axle by toothed gears. A really modern feature on this engine is the solid side rods, made exactly as are those of to-day—that is, of rectangular section and fitting the pins without straps, bolts or keys. The "Dragon" is a Baldwin engine of 1848, with four coupled wheels and outside cylinders, but no truck. The rods on this engine are turned and polished. This is the original machine exactly as it left service. The "Pioneer" is also an original Baldwin engine, built in 1848. This engine has single drivers and half crank axle, a four-wheel leading truck and Bury boiler. The last to be noted is an eight-wheel Mason engine built in 1853, the original engine as delivered to the Baltimore & Ohio Railroad. This engine is, in design, the peer of any modern machine built, as far as appearance would indicate. The only things about the engine that takes the observer back to the period of its birth are the pumps on each side and the brass trimmings, both of which have long been extinct, but in general the machine would be a fine passenger engine for her size to-day—giving Mr. Mason the prestige of being many years in advance of his time as a designer of locomotives.



BY-PASS OF ROGERS COMPOUND.

There are other engines in this exhibit that will well repay anyone interested in these records, among which are a ten-wheeled "camel back" of 1852 and a ten-wheeled Thatcher Perkins engine of 1863; but enough has been said here to show the value of the collection—one that will be prized, as time rolls on, by every man who has to do with the locomotive.

The first charter ever granted in this country, or probably any other, for the building of a railroad was granted in 1819 to Henry Drinker by the Pennsylvania legislature, for a road of that kind from the Delaware valley to the headwaters of the Lehigh river, over the route now occupied by the Delaware, Lackawanna & Western Railroad from the Water Gap to Scranton. That was before the days of steam and the "waggons" that were to be run on the road were to be moved by horse power. That old charter and the rights it conveyed were purchased by the original Delaware & Lackawanna Company for $1,000.

How Sixty Miles an Hour Was Made Sixty Years Ago.

A cutting from a newspaper has been sent us by Mrs. J. C. Baker, of Columbus, O., which recites the romance about Edward Estwistle, now living in Iowa in his eighty-sixth year, having run Stephenson's famous "Rocket" when it first was put into service. The old man is reported as saying that he often ran 31 miles in 30 minutes with the old engine. He also says it began work in September, 1830. History says that the competition which made the "Rocket" famous took place a year earlier. We have no doubt that he believes the tale which he tells, but he was only thirteen years old when the "Rocket" began running, and children of that age were not engaged to run pioneer locomotives. Mrs. Baker, writing about the article, says:

"Now, I don't doubt the old man's word in the least when he says he made 31 miles in 30 minutes. I am nowhere near eighty-six yet, but I have some recollection of what roadbeds and rails were, say, twenty-five years ago, and I venture to criticise the aged story-teller on just one point. He thinks he's alive, but he isn't. He was killed in a railroad wreck at least sixty-five years ago.

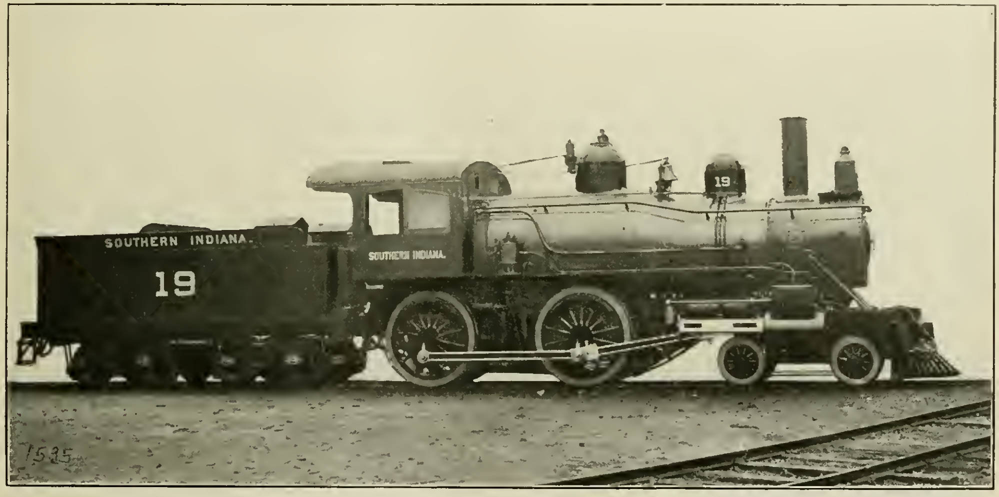
"He should read Joaquin Miller, the poet of the Sierras who tells somewhere of an old miner who is relating his adventures. After numerous thrilling escapes, the miner and his party are finally so surrounded with dangers that death seems inevitable. A listener, overcome with suspense, asks, 'How *did* you escape?' 'Didn't,' answers the miner. 'Every last one of us was killed.'

"And I think that is what happened to all the engineers who made 60 miles an hour sixty years ago."

New Locomotives for the Southern Indiana.

The annexed engraving illustrates an eight-wheel passenger engine recently built by the Baldwin Locomotive Works for the Southern Indiana Railway.

The engine has cylinder 18 x 24 inches, balanced valves and driving wheels 66 inches diameter. The boiler is of the wagon-top type, 58 inches diameter at the smallest ring and carries a working pressure of 180 pounds to the square inch. The firebox is 78⅜ inches long and 34 inches wide. In front it is 84 inches deep, and at the back 83 inches. There are 246 2-inch tubes, 11 feet 8¼ inches long. The heating surface is 1,643.4 square feet, of which 1,494.6 square feet are in the tubes and 148.8 square feet in the firebox.



BALDWIN SIMPLE EIGHT-WHEELER FOR SOUTHERN INDIANA.

Advertising the Detroit & Mackinac Railway.

This is a fine piece of book-making and is not only of value to the railway but to the section of country included. Interesting in description, valuable in the information it contains on the beet-sugar and lumber industries and finely illustrated, it is a book that deserves careful attention.

The story is a record of a trip made in the lower peninsula of Michigan by editors of newspapers published in Detroit, Northville, Flint, Bay City, Saginaw, Alpena, Philadelphia and other cities. It faithfully depicts the marvelous changes that have taken place in this section of the State and indicates the evolution from the lumbering operations, the principal product of Michigan, for so many years, into that of the beet-sugar industry, the manufacturing, mining and agricultural pursuits as are followed to-day and which were faithfully described by the newspaper men on this memorable trip.

European Railway Jottings.

BY CHARLES ROUS-MARTEN.

It may perhaps be advisable that in this, my first letter of the new year, I should offer a brief recapitulation of some of the principal features of the past year's locomotive engineering in Great Britain, and more briefly that of the European Continent.

On the whole, the year 1901 has not been particularly fertile in the production of novel types for express passenger work. Its most characteristic new departures have been in respect of goods engines. But although there may have been a lack of striking novelties in the case of British express engines in 1901, there has been a considerable output and development of the newest types already existing. On all hands the tendency has been to follow the wise example previously set by the engineers of America and Europe in the direction of enlarging the power of the locomotives in that most important of all, its capacity for steam generation. After denying for years that more powerful boilers were needed and insisting that the former dimensions were ample for the fulfilment of all reasonable demands, notwithstanding the excessive prevalence of piloting, or "double-heading," as I believe it is more generally termed in America, locotive engineers of Great Britain have awakened during the last two or three years to the fact, that while their locomotives are at least equal to any others in the world as regards efficiency *per unit of nominal power,* they are deplorably wanting in the number of such units as compared with the engines employed elsewhere.

On all, or nearly all, of the principal railways of Great Britain this deficiency is now being steadily, if gradually, supplied. Even yet there appears in the ma-

jority of cases a certain amount of shyness or nervousness in entering upon the new departure tacitly admitted to be necessary, but the climb from 900, 1,000 or 1,100 square feet of heating surface to 1,500, 1,600 and 1,700 square feet has been continuous and persistent, and in two cases at any rate locomotive designers have ventured to adopt heating surfaces exceeding 2,000 square feet. Only Mr. J. A. F. Aspinwall, of the Lancashire & Yorkshire, and Mr. P. Drummond, of the Highland Railway, have as yet, it is true, had the courage to make this big plunge into such greatly expanded boiler dimensions. But in several other cases an effort has been made to secure approximately equal boiler efficiency by other means than the mere expansion of heating-surface area. Stress has been laid upon the admitted fact that the vast heating-surface areas of the old London & North Western Crampton engine, "Liverpool," and of some of the Great Western broad-gage, eight-foot, single-wheelers, namely 2,290 square feet, respectively, failed to give results anything like commensurate with the nominal boiler power. In the case of the old "Liverpool" indeed, it was declared that so large a proportion of the internal boiler space was filled up with tubes that very little more than mere froth was to be found in the rest of the space, and that the boiler would probably have been much more efficient with half the amount of tube surface. The case of the Great Western engines was not wholly analogous because the large diameter of the boiler admissible on the 7-foot gage enabled the tubes to be distributed to far greater advantage than in the case of the other engine. And it is an undisputed fact that those Great Western engines gave results far superior to what might have been expected of them with their limited amount of tractive force. I made many observations with them before the extinction of the broad-gage, both with their original boilers and also with their newer boilers which had somewhat less heating surface. And I came to the conclusion that the proportionate excellence of the work which they performed was attributable in a large measure to the valuable abundance of boiler power with which they had been endowed.

Still their case, although in my opinion hardly relevant, but yet more that of the old "Liverpool" prior to the advent of Mr. McIntosh's new eight-wheeled coupled type, may often be heard quoted as an argument against large heating surface. In the present day, however, it is only used in this country by capable engineers in support of other methods adopted for the promotion of steam generation in place of great enlargement of the tube area. For instance, on the Great Western Railway, Mr. W. Dean's newest express engines of the "Atbara" type, with cylinders 18 x 26 inches and driving wheels 80 inches in diameter, four-coupled, have about 1,600 square feet of heating surface, but have vast fireboxes of the Belpaire order which are deemed to be relatively more efficacious than enhanced tube area in the rapid generation of steam. Mr. Dean has brought out twenty more of these engines during the past year.

On the London & South Western, Mr. D. Drummond has produced another batch of his "Caledonian" type, which have 78-inch drivers four-coupled and cylinders 18½ x 26 inches. All these engines, which have about 1,500 square feet of heating surface, possess in reality the equivalent of larger power through the employment of his patent water tubes [illustrated in RAILWAY AND LOCOMOTIVE ENGINEERING of June last] passing through the inner firebox. Several of these have come out during the year, as also five more of Mr. Drummond's four-cylinder non-compound type. All have the water-tube fireboxes which seem to be giving most satisfactory results.

For the London, Brighton & South Coast a number of new express engines have been constructed to Mr. R. J. Billinton's design, similar to the one named "Empress," which drew the Royal funeral train and which I illustrated in connection with a previous letter. In these, enhanced boiler power is obtained through enlarged heating surface in the ordinary type. The engines appear to be giving very good results. The same may be said of the new locomotives designed for the South Eastern & Chatham by Mr. H. S. Wainwright for express services, which have 80-inch drivers four-coupled, cylinders 19 x 26 inches and 1,500 square feet of heating surface.

Mr. T. Holden continues to build his liquid-fuel-burning "Claud Hamiltons" for the Great Eastern Railway. These have cylinders 19 x 26 inches, four-coupled driving wheels 84 inches in diameter and 1,600 square feet of heating surface. Some improvements in details have been introduced in those most recently built. On the Great Northern, Mr. H. A. Ivatt has largely multiplied his eight-wheeled, 78-inch, four-coupled express type which are doing particularly good work, and has also built ten more of nis "990" or "Atlantic" type, which have cylinders 18¾ x 24 inches, those of the eight-wheeled class being 17½ x 26 inches. In each of the e cases the boilers are far larger than those of any previous class of Great Northern standard engine, having 1,250 and 1,440 square feet, respectively. These may not seem nominally large amounts of heating surface, but this is one of the cases to which I referred above of the attempt being made to secure efficiency by other means than mere increase of area; that is to say, Mr. Ivatt seeks by his disposal and arrangement of the tubes and enlarged firebox to get better results than could be obtained by the more rough-and-ready course of simply extending the tube area. He has applied the same principle to ten very fine single-wheelers with inside cylinders 19 x 26 inches and 90-inch drivers, which are quite the latest developments of the single-wheeler method and appear to involve practically the "latest word" on that subject. I have found them perform excellently and do work which theoretically seemed improbable in the case of that type.

On the London & North Western, ten more four-cylinder compounds have been brought out by Mr. F. W. Webb. These closely resemble the "Jubilees," of which forty are now running, but have larger and higher pitched boilers and an additional inch in the diameter of the high-pressure cylinders. Although the boilers of the new engines—which are known as the "Alfred the Great" class, having been built in that king's millenary year—are substantially larger than those of the "Jubilees," there is no material increase in the total area of heating surface. Indeed, that given by the tubes appears to be slightly smaller than before, increased efficiency being sought in this case also by what is deemed an improved disposal of them, and by appending a water bottom to the firebox.

(To be continued.)

Andrew Carnegie's Epitaph.

One incident of last month in the life of Andrew Carnegie was the presenting to the Stevens Institute of Technology, Hoboken, N. J., of an engineering laboratory building which cost $65,000. In the course of a speech presenting this gift, Mr. Carnegie said that he would have put upon his tombstone the epitaph: "Here lies a man who knew how to get around him a great many men who were much cleverer than he was himself." Mr. Carnegie is a good deal of a quiet humorist and the sense of the epitaph is, we believe, a joke. His friends are well aware that the extraordinary success in life achieved by Mr. Carnegie has been done in a great measure in the able assistants that he always selected, but the chief was the cleverest of the clan. An observing man cannot be much in Mr. Carnegie's company without being deeply impressed with the commanding ability of the man and the comprehensive grasp he has of every subject to which he has devoted the least attention. If ever a body of men comes together, all of them cleverer than Andrew Carnegie, that is a congress we would willingly cross oceans to meet.

The Canadian Pacific Railroad has completed arrangements for building immense locomotive and car works in the east end of Montreal. It is said that 7,000 men will be employed, and 350 acres of land has been acquired for the site. The company already has locomotive works in that part of the city, but they are entirely insufficient to meet the needs of the system. It has also a number of car shops at various points, but all these are to be concentrated here. It is proposed that every engine and car needed by the road will in future be built in its own shops.

Locomotive Coaling Stations.

BY WALDON FAWCETT.

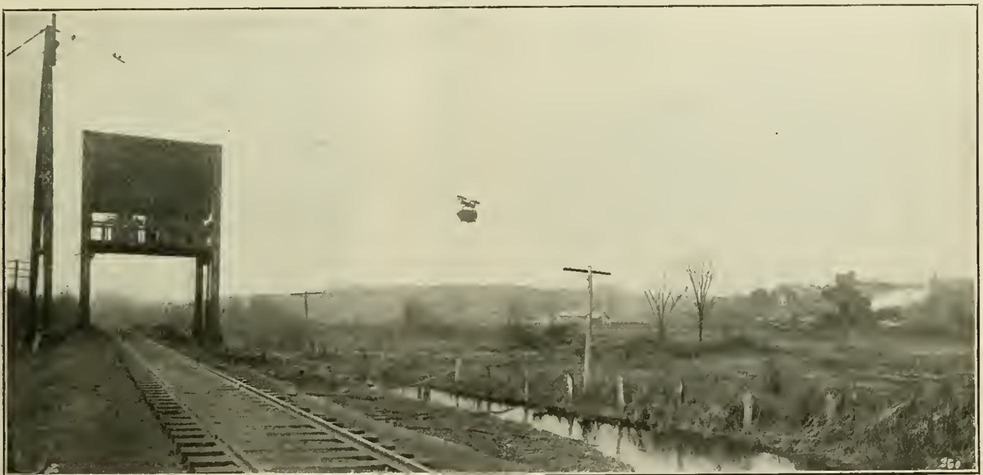
A remarkable advance has recently been made in the introduction for the fueling of locomotives of some of the economic utilities which have proven such revolutionary influences in the handling of crude commodities. The problem involved has been to present a design of locomotive coaling station of the most substantial construction where permanence is required, at a moderate first cost of plant and entailing no exorbitant outlay for the real estate necessary for a site. It was manifestly desirable also to provide a locomotive coaling station using no chain conveyors in order to reduce repairs to a minimum and finally it was essential to devise a system which could be operated at the lowest cost per ton of coal handled. Operations in this field have now passed the experimental stage; indeed, perfection may be said to have been attained and it is interesting to note that the solution is simply the presentation of a new and economical arrangement of old and successfully tried ideas for the characteristic features and the various details embodied in the most approved design have been used over and over again on the various hoisting and conveying machines in use in handling coal, iron ore, limestone and other commodities at the ports on the Great Lakes, at blast furnaces, at the United States naval coaling stations and elsewhere.

The coal-pocket, which is of course mounted above the railroad tracks on which pass the locomotives to be fueled is of steel construction and of what is known as the suspended-bin type, in which the sides and bottom of the pocket take the natural lines of a filled bag suspended from two points. It may be noted in passing that the adoption of this form of pocket constitutes another economy inasmuch as a receptacle of the same capacity and strength can be built with a quantity of material from one-half to three-quarters less than would be necessitated for the construction of the old-style pock ts. Steel sheets are utilized in the construction of the pocket which may be lined with concrete if desired and this storage bin is hung from girders supported on four steel posts resting on stone foundations, while overhead is a corrugated-iron roof having sliding doors over hatches through which the coal is dumped.

For transferring the fuel from the coal cars which have conveyed it from the mine to the coal-pocket and for handling it from the storage bin to the tenders of the locomotives tubs of two different kinds are employed. For the latter operation there are utilized gravity-dumping tubs. These tubs are built of steel, of box form, with two bottom doors hinged at opposite sides, which open after the tub has descended to a fixed point, dumping the coal at a central point on the tender, the spilling or scattering of the coal being prevented by the position of the doors when open. When empty the tubs are counterweighted, the counterweight pulling them back into position to be filled again. The filled tubs being, of course, heavier than the counterweight descend slowly under perfect control of the attendant after he releases them by means of a pendant hand-chain. It will thus be seen that the simple operation of pulling the hand-chain releases the tubs and allows them to descend, dump, return and lock themselves in their former position automatically, ready for refilling, which latter operation is performed quickly as soon as the attendant touches the valve controlling this movement.

In connection with the coal-pockets ash-pits are provided. These are built of steel and placed under the locomotive at convenient points so that the ashes can be cleaned out while coal is being put aboard the locomotive. For charging the coal-pocket and for taking out the ashes there are employed automatic dumping tubs such as are in general use in various parts of this country and in Europe for handling iron ore. The ash-tubs are fitted with two wheels of large diameter at the sides and a small castor in the rear, so that they can be easily moved by the attendant from under the ash chutes to a point whence they can be hoisted into car or bin. For hoisting the coal into the storage pocket it is also possible to use a self-filling and automatic dumping grab-bucket. This latter device obviates, of course, the necessity for filling the bucket by hand-shoveling, and when this form of apparatus is used the coal, on arrival from the mine, is run directly into a pit to one side of the car from which the grab-bucket takes the fuel. Both styles of buckets are made in various sizes, the capacities ranging from one ton upward.

For hoisting the coal for filling the pocket and for hoisting out the ashes there is employed a complete equipment of hoisting and conveying machinery. This consists of an engine with the necessary drums, together with trolley, sheaves, etc., controlled by means of levers by an operator stationed in a small house at the very top of the apparatus, where he has a good view of all parts of the station. One man handles this entire apparatus in all its functions and it has a capacity for handling from 50 to 100 tubs an hour, the one-ton capacity tub being generally used. Attached to each of the large gravity dumping tubs which carry the coal



COALING STATION SUPPLIED DIRECT FROM MINE BY TELEPHERAGE CAR.

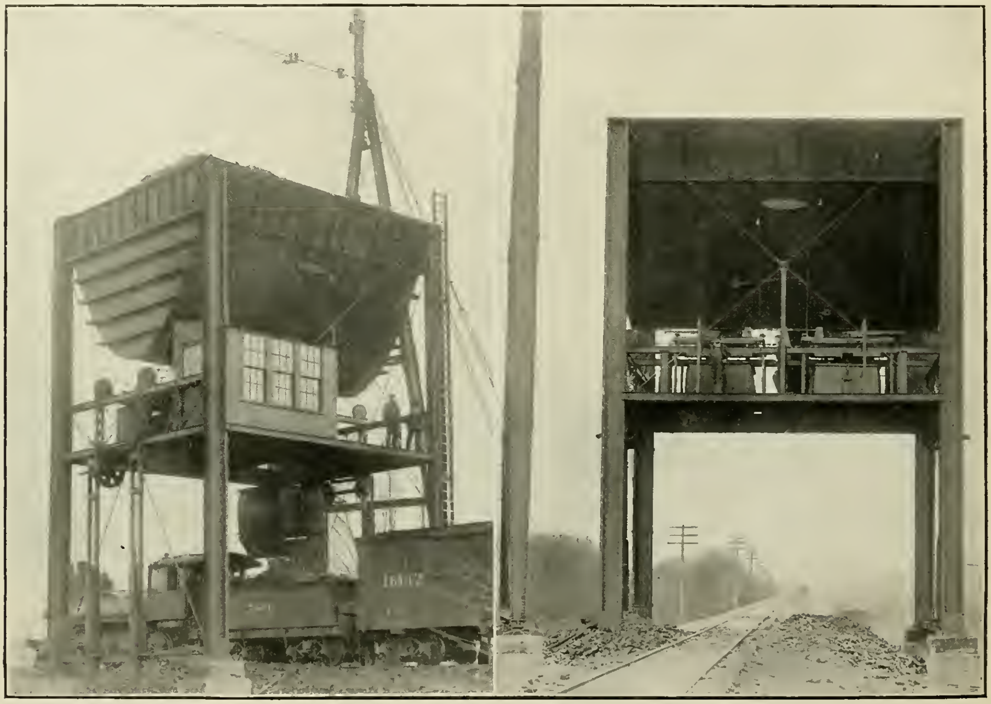
from the bin to the tender is a set of beam weighing scales, thus enabling the weighing of the coal in the tub and keeping a perfect check on all coal furnished to locomotives.

The great feature of these new style plants is found, of course, in the fact that they enable the handling and re-handling of coal with a minimum amount of breakage, a fall of no distance being entailed for the fuel in either operation. However, in some of the more portentious stations a marvelous combination of utilities has been effected. The steam plant of the station supplies the pump for filling the water tank used for locomotive water supply; dry sand is likewise prepared and furnished locomotives from this plant without increasing the working force and finally a dynamo in the engine room enables the electrical illumination of the plant at night.

In some places where a reserve coal supply of large quantity has been required a locomotive coaling station has been constructed in connection with a coal storage and re-handling plant, consisting of either a bridge tramway, such as is used in unloading coal or iron ore from vessels or a cantilever type of machine based on the principle of the great cantilever cranes which are employed to handle heavy material in shipbuilding plants and other industrial institutions. The New York Central & Hudson River Railroad has lately constructed at West Albany, N. Y., a very interesting bridge tramway machine for storing 50,000 tons of coal and supplying the fuel as occasion may require to adjacent locomotive coaling stations.

In this plant the outer or single pier end of the bridge tramway moves on a circular track, storing the coal in a circular pile. The inner or double pier of the machine, on which are mounted the engines and other mechanism, turns on a circular track of smaller diameter surrounding the pit around which the bridge rotates. Coal is delivered on two tracks on either side of the rotating double pier and is dumped and run into a pit directly under the pier, whence it is hoisted in a grab-bucket of 2½ tons capacity and conveyed out over the storage space and dumped. The same mechanism is also used to pick the coal up and convey it back to the cars in which the fuel is shipped to any locomotive fueling station requiring it.

A combination locomotive fueling station and bridge tramway storage plant recently devised has a capacity of placing aboard locomotives 800 tons of coal a day and of disposing of all the ashes taken from the locomotives while coaling. There are seven tracks under the suspended coal bins and one track for filling cars with ashes. The suspended coal-pockets over the tracks have a storage capacity of 2,300 tons and the ash-pocket has a capacity of 250 tons. The bridge tramway storage plant has a capacity of 8,000 tons, and this could readily be increased if desired. In a very ingenious coaling station recently constructed for the Baltimore & Ohio Railroad, at Kings Mines, Ohio, the coal-pocket is filled direct from a mine close at hand by means of an aerial cableway on which are moved automatic dumping buckets similar to those previously described.



COALING POCKETS AT KINGS MINES, ON THE BALTIMORE & OHIO, SUPPLIED DIRECT FROM MINE.

M. H. Treadwell & Co., 97 Liberty street, New York, have favored us with a new catalogue of their freight and tank cars. They are not steel, but are standard and interchangeable, and as wooden cars will continue to be used for a number of years, they are of interest. The illustrations show that they have built cars for many leading roads.

There is at present a movement among railroad companies to require trainmen and all others connected with the movement of trains to make themselves familiar with station signals. The best way to learn about signals is to read "Block Signals," by Elliott, a practical signal engineer. The book is for sale in this office. Price, $3.

Underhung Springs.

BY J. P. KELLEY.

The method of hanging the driving springs and the equalizers of any locomotive is always of interest to the engineer, because he is, as a rule, desirous of knowing the extent of the effect which the failure of a spring or hanger will have in causing delays, when such failures occur on the road.

Nearly every engineer knows that the object of hanging the weight of the boiler and its attachments on springs is to permit the engine to be run smoothly at almost any rate of speed of which it is capable, over rough and uneven spots in the track, without severe jar or shock.

When it was the rule to employ much lighter engines than we have nowadays it was customary to place the driving springs over the driving boxes, allowing them to rest on spring stirrups, that in turn rested upon the top of the driving box, and then by means of hangers and equalizers to suspend the weight of the boiler from them.

As the demand for heavier engines and more boiler capacity increased, the space above the driving boxes, which had been used for the springs and hangers, had to be given up to make room for the larger boiler, which now generally spreads out over the frame at the firebox end, and a location under the driving boxes is now, in many modern designs of locomotives, used for placing the driving springs, hangers and the equalizers.

On eight-wheel engines, of which we will treat only, the arrangement of the springs and equalizers when underhung is not radically different from what we find it when they are overhung, as may be seen by reference to Figs. 1 and 2 accompanying this article, except that it requires an entirely different scheme from that of the ordinary spring stirrups, or saddle, for holding the driving springs in place and for transferring their load to the driving boxes.

Fig. 1 shows the form of hanger, or we might term it underhung spring saddle, that is employed on some engines. It is attached to the driving box, extends downward and encircles the spring at the band. This form of spring saddle prevents the removal of the driving box cellar when it is necessary to pack the driving box, unless the engine is jacked up; otherwise it has proved very satisfactory.

In Fig. 2 the springs are underhung, but the weight of the engine is all transferred to the top of the driving box on account of the long hangers that are connected to the equalizer beams that rest on the top of the driving box and from which the weight is suspended.

A little study of the figures will make clear the manner in which the weight is distributed to, and equalized on, the driving boxes. There are many other methods of hanging the springs under the driving boxes and different designs for the frame hanger brackets, but in principle they are all similar to those shown in the figures.

One thing may be said of the underhung spring, and that is, if it breaks, or if any of its hangers break, there is not the likelihood of the end of the spring getting far out of place or of the equalizer flying up so far that it will be a difficult job to get it back where it belongs. The most difficult part of fixing up a broken spring or hanger on the road, on engines that have underhung springs, so as to get in without heating the driving boxes, as I look at it, is jacking the engine up high enough to get the required amount of blocking in between the top of the driving box and the frame, when necessary to hold the engine level, or in between the frame and the end of the driving spring, or frame and the end of the equalizer, as the case may require.

A few words here as to how to raise the engine up when it is necessary to do so, will not be out of place.

Time is, next to safety, the most important consideration on a railroad as elsewhere; therefore before doing a whole lot of unnecessary work, look the situation over carefully to determine just how much is needed to be done. It may so happen that if a hanger breaks, or a spring, if your terminal is not far away, you can get along without jacking up or blocking up, and so need not cause any serious delay to your train. But if you find that it is necessary to jack up, then I believe in using a wedge to raise the engine with; a screw-jack—well, screw-jacks nowadays are seldom in good enough condition to work the screw in and out without any load on them, not to speak of raising a 50-ton locomotive with them.

Let us suppose the hanger 1 breaks, in either plan, as shown in Figs. 1 and 2. This will let the forward end of the driving spring move up in the hanger bracket

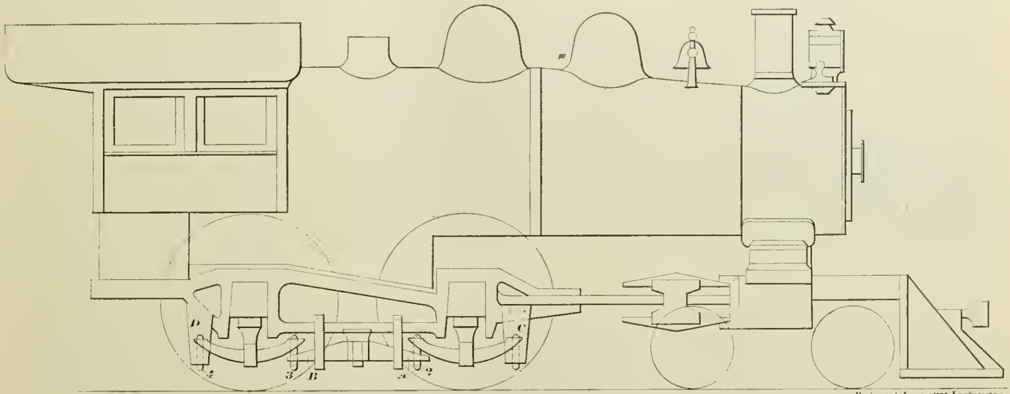
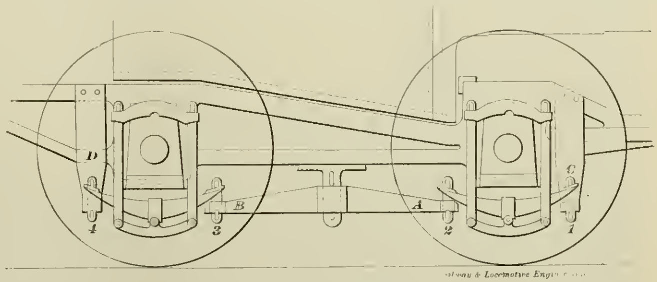


Fig. 1



UNDERHUNG SPRINGS.

C, or rather will let the bracket C move down relative to the spring. In this case we can, by raising the engine up, block in between the sides of the hanger bracket, over the end of the driving spring and the lower side of the frame. Place a wedge having a reasonably long taper under the forward driving wheel, and run this wheel up on it, remove the broken hanger and the gibs, and pry down the end of the driving spring, and fill all the space between the sides of the hanger bracket, the lower side of frame bar, and the top of the driving spring with blocking. The spring cannot get away, and you can proceed, having the use of the other spring, and with your equalizer in proper position. If hanger No. 2 breaks, raise the engine the same way, level up the equalizer, and block it in position between the end *B* and the lower side of the frame; pry the back end of the spring down as close to the proper position as you can get it, and block there, placing your blocks over the top of the back end of the spring, between it and the jaw of the driving box. A chain could be used here to chain up the end *A* of the equalizer to the frame. Should either of the hangers 4 or 3 to back driving spring break, the same method of blocking as described for hangers 1 or 2 may be used, and to raise the engine run the back driving wheel up on the wedge.

Should the equalizer itself break, the engine may be raised by running first the forward driving wheel up on the wedge, then the back wheel, and each time that the wheel is raised fill the space between the frame and the top of the driving box with hardwood blocks, until you have the engine high enough, so that you are able to pry the ends of the equalizer down to where they belong, and to block them there by placing hardwood blocks between the frame and the tops of the ends *A* and *B*. Then the blocks may be moved from the tops of the driving boxes, and you can proceed, having the use of both springs; but your equalizer will not perform its duty, namely, equalize the weight on the driving boxes, as the engine moves over uneven places in the track.

In some cases of equalizers breaking, when the engine is moved up on the wedge, no blocking can be placed between the frame and the top of the driving box, as the equalizing beam is in the way, as shown in Fig. 2. In such cases the equalizer would have to be blocked while the engine was raised on the wedge.

Perhaps the most serious failure to the underhung spring rigging would be that of breaking the hangers that are suspended from the driving boxes, as shown in Fig. 2. If one of these should break—say it was from the forward driving box—the frame of the engine would settle down on top of this driving box and rest there.

To get out of such a difficulty, it would be necessary to remove all parts of the driving box hangers and the spring, raise the engine by means of the wedge, block the end *A* of the equalizer down to its proper position, and block up over the top of the driving box until the frame of the engine is about level.

In some designs of underhung spring arrangement the equalizers are provided with safety straps, as shown in Fig. 1, and some do not have them, as is the case in the arrangement shown in Fig. 2.

However, whether they are provided with safety straps or not, in case of failure of springs or hangers the equalizer is not likely to get badly out of place, as the ends cannot get higher than the lower bar of the engine frame.

Safety Appliances.

Through the courtesy of Mr. E. A. Moseley, secretary of the Interstate Commerce Commission, we have received press advance sheets of the coming annual report, which contains summaries of the leading topics. That on "Safety Appliances" begins:

"The Safety Appliance law became fully effective on August 1, 1900, and the beneficent results of its operation are now being realized. The greatly increased security to life and limb by which the men on freight trains and in freight yards now perform their work is now apparent on every hand. Evidence of the improved conditions resulting from the practically universal use of automatic couplers on freight cars appears in the records of accidents and in the testimony of railroad officials and employés. Further proof from a financial standpoint is also found in the records of the railway claim departments, as well as in those of the several trainmen's associations.

"This gratifying state of affairs is due to the Federal statute, the railroad company's united action and the efficient performance of their duties by the inspectors employed by the Commission. These inspectors, who are competent men of long experience in car and train work, have taken note of all features of operation, improvements and repairs which seem to be germane to the work in which they are engaged, and this has resulted in establishing amicable relations with the employés. The various railroad technical associations, including the American Railway Association and the Master Car Builders' Association, have contributed in marked degree to the success of the law.

"The report then shows that for the year ending June 30, 1901, the number of employés killed in coupling accidents was less than in the preceding year by about 35 per cent., and the number injured was less by about 52 per cent. Attention is called to the form of accident reports promulgated by the Commission under the accident law of March 3, 1901, under which precise definitions are given for the purpose of these reports to the words 'killed' and 'injured,' and that this has resulted in a uniform system of reporting. According to the accident returns for the month of July, only four employés were killed during that month while coupling and uncoupling cars. This warrants the expectation that casualties due to this cause will be less for 1902 than for 1901. For the full year ending June 30, 1901, the number killed in coupling accidents averaged 23½ per month. A table showing the complete statistics for 1893, and 1897 to 1900, inclusive, is given. Another table shows for those years the number of persons killed or injured by falling from trains and engines.

"There was a material increase in the ratio killed in 1900 from the three years preceding, the causes for which can only be conjectured. With the use of air brakes on freight trains it is confidently expected to lessen the deaths and injuries under this head, and it is observed that air brakes were not nearly as generally used in 1899 and 1900 as they are now. It is pointed out, however, that with more powerful locomotives, heavier cars and longer freight trains the use of air brakes on these trains has been the occasion of an increased number of violent shocks, which tend to increase the danger to men on the cars.

"The Commission recognizes that as a rule the railroad companies now need no compulsion to induce them to use automatic couplers, and that it is only in details of a minor character that any road has assumed a critical or reluctant attitude. Both the automatic coupler and continuous power brake are now absolute necessities in the operation of roads which move long trains or use the powerful locomotives and heavy cars which are now common. Thus the policy of Congress in enacting the Safety Appliance law is amply vindicated on what may be called business considerations, without regard to the question of safety of life and limb.

"Attention is called to the dangerous use at the present time of old and weak cars in nearly all trains. This has largely been caused by the great expansion of business, but it is reasonable to expect that every well-managed road will do away with this element of danger as fast as is practicable. The action of the American Railway Association in recommending the adoption of a standard size of box and freight cars is noted and commended."

The new catalogue of the Pond Machine Tool Company, of Plainfield, N. J. (offices 136-8 Liberty street, New York) is devoted to heavy lathes. They include in this all between 28 and 84 inch and the whole catalogue is interesting to any mechanic. We note that unless Λ tracks are ordered they supply the flat bed, which is a modern or rather revived idea and apparently a good one. Those interested in the care and operation of lathes will find this catalogue a useful reference.

General Correspondence.

First Locomotive in Corea.

We note on page 91 of the current number of your journal that in referring to a recent publication issued by the Baldwin Locomotive Works you make the following statement: "It has a frontispiece of the first locomotive built for Corea." Permit us to say that this is at variance with the facts. In March, 1898, the Brooks Works shipped three locomotives to Corea for use on the Seoul-Chemulpo Railway and these were the first to enter this peninsula. A full description of these engines was published in the *Railway Age* under date of November 18th, 1898.

We bring this matter to your attention, believing that you are interested equally with ourselves in having all published statements regarding railway and locomotive matters as accurate as possible.

American Locomotive Company,
Brooks Works.

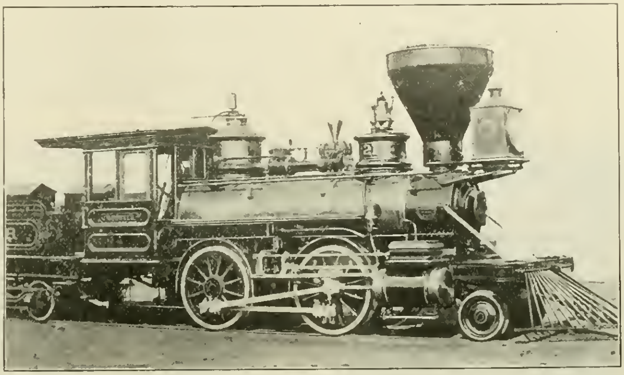
Past and Present Locomotive Practice.

Seeing in your September number a picture of a view on the Carson River, Nevada, from the Virginia & Truckee Railroad, I take the liberty of sending you a photograph of one of the engines on the above road. She is one of the oldest on the road—built some time in the seventies, I think—and when I last saw her was doing switching service in Carson City.

There are a number of these old engines still at work on the Virginia & Truckee, eight-wheelers and moguls principally, and they are splendid types of what builders were doing in that day. The eight-wheelers have 16 x 24-inch cylinders, and the moguls 17 x 24-inch. All have the wood-burning stacks, brass around domes, sand boxes and cylinders; drivers painted red, and all kinds of brasswork and fancy painting wherever there was an excuse for putting it.

I am also enclosing a print of a couple of Union Pacific compound consolidations, coupled up and ready for their train. It is an illustration of the advance that has been made in the last two or three decades.

M. F. Jukes.



THE FIRST.

THE LATEST.

The Question of Grate Area.

When the Pennsylvania road departed from its time-honored customs so far as to build the wide firebox engines with 68 feet of grate, known as E 1, the advocates of the large grate area literally danced for joy. When, however, after a series of tests in competition with the "L" class (having only 33 feet of grate to begin with and often bricked down to 26 feet) it was found that the E 1's burned from 25 to 50 per cent. more coal doing the same work, they began experimenting and bricking down the grate. Finally, as a result, the E 2's came out with about 50 feet of grate.

Once again, however, the old "L's" made them look sick on the coal record and a still further bricking down has been tried until it is now about 32 square feet. I am told that they would brick them down still more if it could be done without interfering with the next section of the rocking grate.

This looks as though the large grate wasn't altogether necessary for best results and it rather weakens the argument that they were needed for the fast heavy trains when we consider that not only the grate but the cylinders were increased as well. If a modified "L" had been built, having the same cylinders as the E's, does anyone doubt their ability to do the same work? We are too apt to compare engines which are not alike in cylinder capacity, or rather, tractive power.

There's another point in connection with fireboxes and grates that doesn't seem to have attention enough. We know that the fire is poorest next to the water space being discouraged by the rapidity with which the heat disappears. Why not leave a dead space of firebrick all around the firebox of, say, 6 inches, or at least 6 inches on each side and by the door, leaving the front to be bricked up as much as desired. I believe this would help the fire and is at least worth trying. FRANK C. HUDSON.

Roxbury, Mass.

Scotch Railway Matters.

I see in the November issue, page 500, of your always excellent journal that silly tale of a Great Northern locomotive having done 4,000,000 miles. This has been round all the papers here as a solemn fact, in spite of the fact that this would mean it had done every day of its life (Sundays included) more than double the mileage any of ours ever do, and also that it had never had a day off for repairs. Nevertheless, it is true that we coddle our locomotives in every way, and get nothing like a decent or economical mileage out of them, and I am glad this idiotic tale has moved you to tail on to it such a pithy and much needed set of real facts.

In your December issue, page 518, I see Mr. Leith, who dates from Aberdeen, Scotland, pulling up Mr. W. T. Reed, whose able letters in yours of October, page 433 (*bis*), one reads with pleasure. Mr. Reed, with his wide experience of railroading and locomotives in Great Britain and over the world, is well able to take care of himself; but I think it a pity your readers should be misled by some of Mr. Leith's remarks. I read Mr. Reed to mean that single-wheelers are only useful to take the King when using a few saloons —in short, that they are only useful for very small trains with no stops. It is self-evident—but we need not waste time over them, as they will soon disappear now.

Outside cylinders will soon be quite common in Great Britain, because compounding compels them, and also because more and more passenger locomotives are to be six-coupled. Perhaps, on the whole, they are best, but they have distinct drawbacks.

I have perhaps had a larger experience than Mr. Leith as to the opinions of drivers in England and Scotland who have used both Westinghouse and vacuum brakes, and can say distinctly that I have never met one of such who did not out and out prefer the Westinghouse. It stands to reason that men will like a quicker, more powerful and more certain article. One has only to use one's eyes and ears to know that trains fitted with vacuum brakes have to be started constantly with the brakes more or less on.

NORMAN D. MACDONALD.

Einburgh, Scotland.

Acetylene Headlights.

Some time since I wrote a short sketch of the acetylene gas headlight in use on various roads, and mentioned among others the Southern Pacific, Chicago & Northwestern, and the Santa Fé.

The *Engineering News* recently claimed all of the roads named were equipped with generators of the Cooke patent, and I have received several letters asking about the same, and upon investigation find that the Southern Pacific system has 175 lights of the McDonald & Elliott patent in use and so far as I can learn not a single gaslight of any other description. The Atchison, Topeka & Santa Fé has 47 Elliott lights, and engines No. 215 and 908, of the Chicago & Northwestern, are also fitted with Elliott lights. This line has one other engine equipped with another make of machine.

The question is also asked about the cost of equipment. Everything, including new material, changes on reflectors, labor, etc., bring the expense slightly below $40 per engine.

Taking into consideration the facts that these lights give about four times the light of an ordinary oil lamp, that there is no danger of them taking fire and burning out, and they require no wick or chimneys, all at about the same cost per mile for operation, it is not to be wondered at that they are rapidly coming into favor among railroad officials everywhere.

There have been shipped to Mexico, for various roads, within the past two months more than one hundred of this pattern of generator. F. L. DILLON.

Garrett, Ind.

Cylinder Lubrication.

The difficulty of lubricating the valves and cylinders of modern locomotives furnishes a problem that is seriously engaging the attention of all concerned. With the introduction of the Sight Feed Lubricator it was thought our troubles in that direction were at an end, and we credited the lubricator with more than it deserved, in believing that its feed was continued under all conditions of service. With the change from moderate to extremely high steam pressures the failings of the lubricator began to show, until we became convinced that the supply of oil to steam chest was not continuous, but intermittent. We learned then that with engine working under full throttle, especially at slow or ordinary speed, there was no circulation between the lubricator and steam chest, and that a certain amount of condensed steam accumulated in the oil pipes commonly known as the "water seal."

This intermittent feed was not suspected when moderate steam pressure was used, for the reason, perhaps, that the conditions of temperature of cylinders and nature of steam at, say, 140 pounds pressure were such that the oil supply between shutting-off points, or places where engine slipped or throttle was eased off, so that the balance of pressure was in the oil pipe, the oil that was supplied at one of these periods was usually sufficient to maintain proper lubrication until the next similar period.

With the coming of the modern engine, having a steam pressure of more than 200 pounds, the conditions relating to cylinder lubrication were materially changed. The lubrication was immediately found to be defective. The quality of oil was questioned, carefulness of enginemen doubted, if not actually charged, and, to say the least, the conditions confronting the mechanical department were anything but satisfactory.

The discovery of the "water seal" no doubt suggested the invention of the "tippet attachment" to maintain a continuous circulation through oil pipes, and it no doubt was successful in a measure, but did not really effect a continuous circulation under all conditions of service. The problem seems to have forced the conclusion that a continuous circulation is a practical impossibility, unless there be some provision made whereby the pressure in oil pipes will be considerably in excess of that in the steam chest.

The most effective remedy that has yet been introduced to overcome the difficulty of imperfect lubrication is the Graphite Feeding Cup, which was invented by a locomotive engineer named Howard, who formerly ran an engine on the Wheeling & Lake Erie Railroad. This cup supplies graphite to the cylinders and steam chests

through the oil pipes, and is used in addition to the regular oil lubricator. The graphite serves as an enricher to the oil, and in that manner, by improving the wearing quality of the oil, the surfaces in steam chest and cylinder are sufficiently lubricated between slipping, easing or shutting-off periods to prevent injury to them.

It seems reasonable to believe that even if oil could be supplied to valves and pistons continually it would still fail to lubricate properly.

Valve oil is composed of a combination of mineral and animal oils, and by combining with moisture (or steam of low temperature) it saponifies—that is, it becomes "soapy," and in this condition spreads, or "smears" the surfaces with which it comes in contact in the steam chest and cylinder. When extremely high pressures are used, it is possible that with the attendant high temperature maintained in cylinders there is not present that moisture necessary to effect saponification, and consequently the efficiency of the valve oil as a medium of lubrication is partly lost, while engine is being worked to its full capacity. However this may be, there is evidently a need of more light on the subject of cylinder lubrication in modern locomotives. THOS. P. WHELAN.

Bellevue, Ohio.

What Ailed the Injector.

Here is a nut for some mechanical genius to crack: In the new roundhouse of the Wisconsin Central Railroad at this point the two stationary boilers are each supplied with water by a No. 7 lifting Monitor injector, old style. The water in the feed pipe is cold, and has a pressure of 40 pounds to the inch. There is a globe valve in the feed pipe, 15 inches away from the injector. The boilers carry 100 pounds steam pressure.

Now, according to the generally understood theory of the working principle of an injector, this arrangement should have a tendency to aid its smooth working. However, the effect is just the opposite, and no adjustment of the globe valve, lazy cock, steam ram or throttle will cause the injector to work without either breaking constantly or wasting water at the overflow.

Why should the pressure in the feed pipe have this effect? J. J. ORRICK,

Minneapolis, Minn. Trav. Engr.

[Use a plug cock in supply pipe in place of globe valve to reduce the water pressure. The loose disk of globe valve probably "flutters" when the pressure each side is nearly balanced. Be sure injector gets full steam pressure of boiler. It should have an independent supply and not be connected in with anything else.—Eds.]

Wants Details of Seneca Collision.

In your January number, in the article on the Seneca collision on the Wabash road, and the fact that the engines of both trains were equipped with electric headlights, and yet collided with such deadly consequences, you say that the excuse is offered that the glare from electric headlights so blinded the engineers that they did not know one another's whereabouts, and that it was a very poor excuse.

I cannot understand why the engineers of these trains, if they could locate one another, committed suicide (it is nothing else) by voluntarily running into the opposing train. Trains meet in the night on curves, where the headlight has no opportunity to warn opposite trains of approaching danger; but this wreck, I understand, was on straight track, and yet the engineers dashed their trains into one another as though there were no trains expected to be met for many miles.

I would like to hear something further in this matter, if you are willing to refer to it again in your next number. Your exceptions to the manner in which train orders are usually written is good. The orders are sent by train dispatcher, who is usually a very experienced man, to an operator, who is often quite inexperienced. The words come fast and it is difficult for the operator to keep up with the sender;

J. Teller, Phot., Frankfurt, Deutschland.

LOST HIS AIR AND STOPPED IN DINING ROOM.

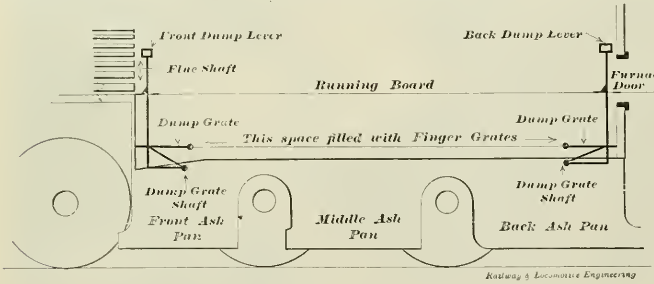
very poor writing results, and I fear that oftentimes engineer and trainmen take the order and run upon it from inference of what they think it reads, rather than from the exact knowledge of what it does read. There is room for improvement in sending train orders. My idea is, that the orders should be written in triplicate by a machine of the same class as the tickers used in business offices, in clear, bold type—one for the conductor, one for the engineer, one for the operator. There has been no improvement in the manner of sending and writing train orders, practically, since trains were first moved by telegraph.

GEO. H. BROWN.
Dubuque, Ia. Dist. M. M.

[We have not been able to obtain any more information about this extraordinary collision. Those who understand more about it than we do will not tell anything.—Ed.]

Drop Grates on the Louisville & Nashville.

I send you a description of the back drop grates as used on the consolidated engines of the Louisville & Nashville in the South. These engines have a firebox 11 feet long, and the coal we get sometimes is very poor, owing to the scarcity of fuel during the busy season.



A DUMP GRATE.

This dump grate was gotten up by Mr. Harry M. Minto, master mechanic of this system at Mobile, Ala., and it is one of the handiest and most labor-saving appliances I think that has ever been put on locomotives of recent date. When it is necessary for you to clean your fire on the road, all you have to do is to drop this back dump and pull it out, and, as everyone who has ever cleaned a fire knows, it is a great deal easier to pull fire than it is to push it through the front dump, especially when every little clinker sticks in it and you have a very hot fire to work over. The engineer and firemen on this division are very well pleased with this improvement, as it saves them much labor and exertion.

JOHN F. MULLEN.
Montgomery, Ala.

The Vacuum Gage.

Not so many years ago it was customary to estimate by guess nearly everything pertaining to the requirements of the locomotive. If they steamed poorly it generally required several changes in the front end arrangement made experimentally to see if that would improve matters, and what engineer of ten or more years' experience but has taken part in heated discussions in the roundhouse regarding the things that should be done to improve the steaming qualities of some poor steaming locomotive, yet if asked the reason why the engine did not steam well, would probably be puzzled to give a clear, satisfactory answer.

Then the hauling capacity of the locomotive was generally, previous to the tonnage rating system, stated in cars, and the engineer in charge of the engine would not think of finding any fault with the load attached, if it was all only in the rated number of cars, regardless of the tons the contents weighed. This was before the capacity of cars was quite so great as it is to-day.

In his little work on the steam-engine indicator Mr. W. Barnett Le Van says: "In every branch of science our knowledge increases as the power of measurement becomes improved," and I was rather forcibly reminded of this truth while reading the editorial which appeared in RAILWAY AND LOCOMOTIVE ENGINEERING last month on rating the capacity of the locomotive in which it was suggested that a dynamometer be built into the drawbar, so that the hauling capacity of the locomotive might be accurately ascertained under all conditions and in all kinds of service, as well as under the varying conditons of the locomotive itself.

If an engine steams well, the drawbar pull does not worry the engine crew very much, for the yardmaster may be depended upon to make use of all that pull; but if the locomotive does not steam well, then there is sure to be more grief for the engine crew, no matter how much the load behind the tender may be.

A good steaming engine is a joy to the crew, and I believe there is scarcely an engineer who will not hail with delight anything that will tend to bring about this desirable attribute of the locomotive, and will do all he can to assist in maintaining it.

Nearly every engineman, if asked what produced the draft in the firebox, would answer that it was caused by the suction of the exhaust steam escaping through the stack; but if asked if he could measure or tell exactly the force of the draft on the fire at any time, he would very likely answer that he could not, because he had no means of measuring it.

As our power of measuring increases our knowledge in every branch of science, as Mr. Le Van tells us, let us see what it will do for us in the case of drafting a locomotive.

It is well known that the air has pressure or weight and that the pressure is generally about 14.7 pounds per square inch, varying a little sometimes one way or the other, but not enough to make any great difference, except where delicate calculations are required.

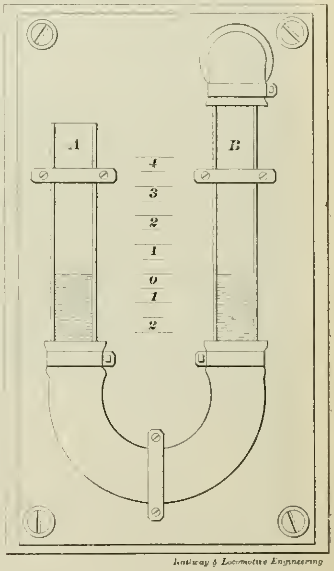


FIG. I.

If we try to remove the air from a vessel by means of a piston or plunger, we will find that we cannot do it successfully, unless one end of the vessel is closed tight. In the case of the locomotive at work, it is a constant effort on the part of the exhaust steam to remove the air from the smoke box and the surface of the fire, while the weight or pressure of the atmosphere is forcing air up through the grates, and in through the fire door to take the place of that removed by the exhaust steam.

The air that is made to pass through and over the fire in this way furnishes the oxygen necessary for cumbustion. If there is an insufficient supply of air, there will be imperfect combustion, with the result that the engine will not steam well; if

there is too much, then there will be a loss in the extra quantity of fuel burned, and possibly poor steaming.

To enable us to determine just the proper force for the draft there is now used, on some roads, on the locomotive, what is termed a vacuum gage.

The form of vacuum gage shown in Figs. 1 and 2 is the one used on the locomotive for measuring the vacuum in the smoke box, and consists of a U-shaped tube, made of glass and rubber tubing, that is clamped to a board, so that it may be conveniently fastened to the interior of the cab, generally on the left side, where it can be easily seen. The height of the tube is about 8 or 9 inches, and water is poured into it until it fills both legs *A* and *B* to the height of about 4 or 5 inches.

As will be seen from Fig. 1, the water in the legs of the tube is of even height, and the line drawn across the board at the surface of the water is marked zero; the spaces above and below the zero line are marked in inches and fractions of an inch.

The longer leg *B* of the tube is connected to the smoke box by a pipe, and the pipe enters the latter a few inches below the base of the smokestack saddle. All connections are made absolutely air tight, so that no air can get into the tube, except from the smoke-box end and the open end of leg *A*.

When the locomotive is working, the exhaust steam passing out through the smokestack produces a rarefaction among the air and gases in the smoke box; that is, the air and gases are entrained by the exhaust steam and carried out by it.

The air in the pipe connecting the leg *B* to the smoke box is affected by the reduced pressure in the smoke box, due to the removal of the air and gases, and is induced to flow into it, and in this way the pressure is reduced on the surface of the water in the leg *B*. Leg *A* being open to the atmosphere, the pressure of the air on the surface of the water in the latter forces it down in leg *A* and up in leg *B*, as shown in Fig. 2.

The height to which the water rises in leg *B* is an indication of the amount of rarefaction, or vacuum, produced in the smoke box. Here, then, we have a convenient means of measuring the force of the draft on the fire under all conditions of service, and all methods of handling the locomotive, and by observing the vacuum gage carefully, when changes are made in the throttle and the lever adjustment, we are able to see the exact effect such changes produce on the shaft.

The condition of fire, height of water in the boiler, the quantity of sparks or cinders in the front end, the slipping of the driving wheels, direction of the wind, and so forth, all influence the draft, and all these effects are faithfully indicated by the vacuum gage.

There are also a number of other things, such as valve adjustment, size of stack and matters pertaining to the general design of the locomotive that influence the draft, but intelligent observation of the vacuum gage will enable engineers to tell closely how much the draft is influenced by them, and the information gathered in this manner is reliable and furnishes the correct basis for intelligent action when front-end changes are needed, and, too, will assist greatly in bringing about the best front-end arrangements possible to be had.

In 1896 the Railway Master Mechanics' Association made tests to determine accurately what the true action of the exhaust steam is on the air and gases in the smoke box in producing draft, and the report of their findings is embodied in the Proceedings for 1896 and 1897.

Previous to those investigations it was supposed by many that the exhaust steam acted like a piston in the smokestack, and that the exhaust was in reality a regular

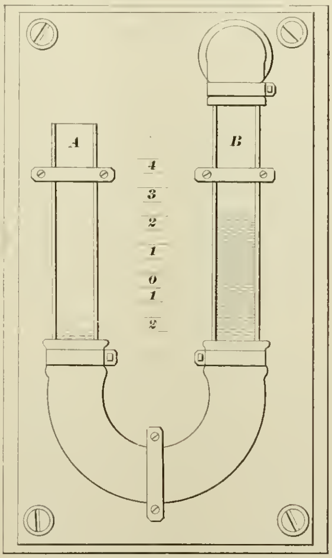


FIG. 2.

air pump, but they show that whatever draft is produced on account of the exhaust steam passing to the stack, is due to the friction of the exhaust jet upon the air and gases that come in contact with it and are entrained by it.

In these investigations the vacuum gage played a very important part. Another thing that the vacuum gage shows, that it is interesting to observe, is the effect of heat in the smoke box on the draft and how much draft there is on the fire when the engine is running along at a high rate of speed, with throttle closed and reverse lever in the different notches between the center and the corner. Take, for instance, an engine that has been working hard for some little time; naturally the front end becomes very warm, and when the throttle is closed and the engine stops, instead of the water in leg *B* settling down to the zero mark, the height of the water in this leg will remain quite a little distance above zero point, showing that the heated air and gases are still passing up through the stack, without the assistance of the exhaust, at a sufficiently rapid rate to cause some vacuum in the smoke box, and consequently something more than a natural draft on the fire. As the smoke box cools down it will be found that the water in the legs of the tube will approach more nearly the zero point, although the water in leg *B* will always remain a little higher than that in leg *A*, due to the natural draft which the boiler may have.

A good blower is a very convenient thing to have on an engine, and when it is turned on, the vacuum gage will tell about how much work it is doing and something of the condition of the fire.

So many earnest wishes are expressed by railroad officials that economy be practised in firing locomotives, that the firing be done without making any more black smoke than is absolutely necessary, it seems to me that if the steam engine indicator, the vacuum gage, the dynamometer and other measuring instruments were intelligently and freely used, some very satisfactory results would be likely to follow.

J. P. Kelly.

Ran 5 Miles with Pilot Pushing Ties.

A forcible argument toward the application and maintenance of good headlights was brought to the attention of some engine and train men on one of the Western roads a few days ago. The engine, of the large consolidation type, was equipped with one of the little dinky lamps, and in pooled service was anything but clean. A certain sidetrack was in bad order, due to rains settling the fill about midway of its length. The trackmen had placed some cross ties on the rails to give warning of the obstruction, and when the "hog" headed in, the light was too dim to enable the engineer to see the ties, with the result that they were crowded under the pilot and carried past the brakeman to the next station, the 5 miles covered in about 14 minutes.

The crew chopped them out before heading in, only discovering them when the brakeman walked over them to open the switch at the first station. Five-degree curves were rounded on the way, and only luck kept them from wrecking the whole train.

The Chicago Pneumatic Tool Company report that since their reorganization orders for compressors, pneumatic tools and appliances, including cranes and hoists, received from the 1st to the 15th of January equal the total December business, which was greater than that of any preceding month. This also includes an order for eighty tools from the Cramp Shipbuilding Company.

Railway and Locomotive Engineering

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Smoke Prevention in Chicago.

Ever since steam boilers came into use the people of cities have been protesting against the smoke nuisance and their representatives have been agitating for laws inflicting pains and penalties against boiler owners for the damage done by the black smoke poured from furnace chimneys. All has been of no avail and every city where bituminous coal is used as fuel continues to taint the breath of heaven with coal fumes and paint the public buildings black with the lamp-black poured out of the chimneys. It has been well known to people informed about the principles of combustion that coal could be burned in furnaces without creating a steady outpour of black smoke, and hundreds of furnaces have been designed which were effectual smoke-preventers when intelligently attended to. Many of these furnaces have been put into successful operation and did their work satisfactorily until the people in charge became weary of well doing, then by degrees the smoke-preventing features were neglected and the smoke nuisance became as imposing as ever.

As long ago as 1804 James Watt, the famous improver of the steam engine, invented and patented a smoke-preventing furnace which was designed according to scientific principles, and it was an effectual remedy against smoke so long as it was properly cared for. Very many inventors followed the lead given by Watt, many of them having labored to devise a furnace which would burn coal smokelessly without human care. These people have always failed, and the probability is that their successors will always find their labors abortive when they attempt to dispense with human intelligence. So boiler users and metallurgical furnace owners have gone on year after year filling the air with smoke and painting black many of the most beautiful buildings that the mason's art has ever produced. Many people have become fatalists about this evil and lament that the destruction of beauty and the undermining of health from the smoke nuisance is one of the inevitable evils of manufacturing and industrial activity. We have never believed this, and we have lately received an object which convinces us that the people of any town or city can succeed in suppressing the smoke nuisance if they arise in their might and show that a demand for the prevention of smoke is sustained by decided public sentiment.

For years certain scientific men in and about Chicago have been agitating against the smoke nuisance which made a cloud of grime hang over the city at all times. In various ways they led the people interested to understand that smoke was not a necessity with coal burning but a preventable evil, and they got ordinances passed for the punishment of those who persisted in causing smoke to a disagreeable extent. The movement for cleaner skies and a purer atmosphere was helped along and kept in motion by certain enterprising newspapers which sent out photographers frequently to take pictures of smoke-emitting chimneys. The photographs were published almost daily for months, and there was no denying the testimony which they furnished. The penalties which the city ordinances provided against the smoke nuisance did little good, but the moral effect of the pictures stirred the delinquents out of their apathy, and by degrees nearly all owners of furnaces began striving to keep their fires going without injury to their neighbors and to the city generally. The more enterprising steam users remodeled their furnaces on plans recommended by smoke-preventing experts; but in most cases material changes were not necessary. A local paper that had been very active in illustrating and denouncing the smoke nuisance recently published a list of 354 boiler plants, apartment houses and other establishments which are now practically free from smoke, although they had formerly given good cause for complaint. The remedy in most cases was effected by introducing intelligence and skill where ignorance and carelessness had formerly held sway. The *Record-Herald*, of Chicago, discussing this subject, says:

"It is interesting to note that the great majority of the men who have triumphed over the evil have one prescription for those who still delay in pointing out the right way to seek a remedy. It is 'Exercise a little common sense.'

"It is impossible to lay down any fixed rule other than the above for those who are anxious to keep chimneys from spreading filth about the city. Every plant has its own peculiarities, and no two boilers work in exactly the same way. An engineer who understands his business and well-paid firemen over whose labors constant watchfulness is exercised seem to be the two great essentials, and starting from this point there are many things to be abolished and avoided.

"The collected testimony concerning the greatest stumbling blocks in the way of freedom from smoke that the *Record-Herald* is giving to its readers is of a plain, practical character, coming as it does from men who have thought out their own way to success, and who have reached the position where the problem has ceased to have any terrors or obstacles for them."

The writer, who has for many years taken a keen interest in smoke prevention, recently spent a week in Chicago and he was very much pleased and surprised to note the improvement which has been effected in a year. His conclusion is that to-day Chicago is the least smoke-inflicted city in the country of those where bituminous coal is the principal fuel burned. There is still room for decided improvements. The owners of high office and large department store buildings are now the principal offenders, and railroad companies are not far behind; but if the spirit which brought about the improvement is kept active Chicago will soon become an example to all other cities. The city council appear to take a highly intelligent interest in smoke prevention and regulations have been established which will prevent backsliding on the valuable work accomplished.

Compound Engines.

What there is in the compound locomotive will be settled to the satisfaction of the Northern Pacific officials when all returns are in of the performance of the different types of compounds on that road. There is no doubt this is the most extensive trial of compound engines under way on that road, of any in the railroad world, there being one or more of each type of the machine built in this country, and all having an equal chance to show to the best possible advantage what there is in the claims of the several builders of compound engines.

In 1891 the first test of a compound on the above road took place, and it was of a most exhaustive character, differing in that respect from the service trials of the engines under discussion, the test engine being fitted with a calorimeter, a pyrometer, water meters and indicators, and every effort made to cajole every pound of coal into yielding up all the thermal units it was supposed to possess. We happen to know that the results of that test did not go unquestioned, and the sole reason therefor was the fact that the engine showed an economy of 22.5 per cent. in fuel consump-

tion over a simple engine exactly like the compound except in cylinders. This was too serious to go unchallenged.

Eleven years have seemingly worked a marked revolution in the way some people look at things mechanical, and the fact that we no longer hear of such tests as being a necessary part of the compound argument is good proof that those machines are now out of the experimental stage, and the most convincing proof is to see them in regular service without any of those test frills. Performance sheets now tell the story, not accurately, perhaps, but good enough to show a balance where it will do the most good.

Meddling With Locomotive Management.

There is an impression that locomotive engineers on the American continent take more upon themselves in dictating to their superior officers about their duties and the engines they handle than the enginemen of any other country. After reading an account lately of a meeting of English engine drivers, we concluded that as meddlers with questions they did not understand, the English engine drivers went beyond anything we ever heard of in this country. It seemed a case where fools rush in where angels fear to tread. After heartily abusing the big engines coming into use, which one speaker believed would be called upon to haul 60 wagons (about 480 tons), the speaker agitated in favor of an expert belonging to the Board of Trade (Government bureau) being required to examine all locomotives. The chairman of the meeting moved: "That we instruct the general secretary to ask the president of the Board of Trade to cause an examination of all high-pressure engines, with a view to reducing the pressure, as in our opinion they are not safe to work." He said many men on the North Eastern would not be surprised to hear of engines blowing away. He believed some of them were at 200 pounds pressure and drew enormous loads. He believed it would be found these engines would not stand the strain where gradients varied. Mr. Day seconded the resolution, and said that, as an engine driver, he believed the large engines were no gain to the company, for they required twice as much coal, three times as much oil, and did damage to the permanent way. One of these engines, built only two years, had to get a new boiler, while many of the old ones lasted twenty-five years. There should never be more than 150 pounds pressure. Mr. Plumb said the North Eastern Railway Company were starting now to put sixty laden wagons to one engine, which he considered very dangerous. Other speakers followed, and the resolution was carried unanimously.

There is a good deal of grumbling among the enginemen on our roads where the monster engines that the men call "battleships" are put to work, but there has never been any movement to induce the Interstate Commerce Commission to dictate to railroad companies about what type of power they should employ or what weight of trains they should haul. Far less has there been any tendency for our enginemen to dictate about proportions of engines or boilers or to assume that they were judges of proper boiler designing. The average American engineman knows infinitely more about the details of locomotive designs than the same class in Great Britain; yet their knowledge makes them modest and they are contented to handle the engines assigned to them in the assurance that the locomotives are the work of designers and builders who understand their business.

It is safe to assert that in the meeting of English engine drivers where the resolutions quoted were adopted, no man in the crowd could calculate the strains that boiler and firebox were subjected to; and yet they were ready enough to pit their ignorance against the knowledge which men trained to the business of engine designing possessed.

An English wagon, as the freight cars are called, very rarely averages 8 tons when loaded. These men were whining because the company proposed putting sixty of these on a train, the whole weight being about 500 tons. There are numerous trains in this country consisting of sixty cars each, or more, each weighing 40 tons and over, all hauled by one engine, and no complaint heard from the engine crew.

Prodigious Coal Saver.

A cable dispatch to the New York *Sun* from London on February 16th says: "Assertions have been made in the press in the past few days that a new valve mechanism, which has been tested on the Great Northern Railway, will reduce coal consumption 40 per cent. and that a locomotive thus fitted and with 140 pounds of steam will do more work than an ordinary one with 210 pounds. The president of the road told the stockholders yesterday that its importance was probably exaggerated."

It must have been a surprisingly modest reporter who sent that message through under the waters of the Atlantic, since he did not make the saving 50 per cent. That is an easy amount to retain in the memory. When we read the item, we supposed that one of our valve motion visionaries had strayed across the Atlantic to startle the natives there who have not become inured to such claims. We tremble for the future of the much-abused link motion; but it has a habit of coming out on top under assaults to which the principal in a football match is no circumstance; so it may bob up serenely after the valve mechanism being tested on the Great Northern Railway gravitates to the scrap heap.

The same dispatch intimates that another epoch-making invention was recently perfected in Germany, which "the highest authorities" affirm will revolutionize the motive power of the world. It is a little hard on Americans to be compelled to wait on the slow movement of the mails for particulars on these epoch-making inventions; but we must possess our souls in patience, in which we will be aided in doing by the remembrance that many revolutionary inventions have been offered to our capitalists which were not considered worthy of investigation.

BOOK NOTICES.

"Furnace Draft by Mechanical Methods." By William Wallace Christie. Published by D. Van Nostrand, New York. Price 50 cents.

A little book by an engineer who has worked and written much along these lines. It is not claimed to be complete (but it is probably better than some which claim more), but gives the facts brought out by the experience of the author in this line. Credit is given others where possible, and no particular apparatus is mentioned or concerned. Anyone who is interested in the question of draft—and that means everyone connected with engines and boilers—will find much of interest and value in this little book.

"A Manual of the Steam Engine, for Engineers and Technical Schools." By Robert H. Thurston, A. M., LL. D., etc. John Wiley & Sons, New York. Price $10.

This is the most exhaustive book on the steam engine that we have ever examined, and it would take no small amount of research to find a subject of any importance connected with the steam engine that is not treated in a thorough manner. It consists of about 2,000 pages of reading matter and illustrations, the pages being 4 x 8¼-inch pages of good, clear type that make up about 370 words to the page; so the student who sits down perseveringly to read through the book will go over 740,000 words. We mention these facts to indicate the immense amount of work that has been involved in the writing of this masterly book.

Dr. Thurston is a voluminous author, but this latest effort made is by all means the greatest of his works. The first part contains the salient points of theory and an account of the gradual development of the engine from the crude forms of earlier times to the elegant and efficient types familiar to the engineer of to-day, and also a description of the general structure and the various special forms of the modern engine. In short, the first volume constitutes an exhaustive illustrated history of the steam engine, with philosophical discussions of the developed forms. The second volume gives the principles of general design of the construction of the details of the machine and the methods of operation and repair found satisfactory in recent practice.

The book is intended more for the student than for the general reader, but it is written in such an interesting style that one can read it for a week and find it as alluring as an ordinary history. In the course of reading the book, we have encountered many statements which we cannot agree with, but with a few exceptions they are mostly points where difference of opinion might be expected. In tracing the development of the steam engine we think Dr. Thurston has sometimes given the encyclopedia views of the real inventors and improvers, and in such cases the authority is nearly always biased away from the truth. It is very rarely that an encyclopedia tells the truth about the men who deserve the credit for engineering inventions. Even worse than the encyclopedias are the romances of Samuel Smiles published under the guise of biographies. We are afraid that the author has used as gospel some of the Smiles fictions.

In one place the author says that George Stephenson was the first to apply the blast pipe into the chimney of the locomotive for the purpose of intensifying the draft. Thorough investigation of this question was made long ago by British engineers who took part in the development of the pioneer locomotive, and the verdict was that William Hedley first turned the exhaust into the chimney in his "Puffing Billy," which Stephenson used as a pattern when building his first locomotive, but that the first man to understand the action of the exhaust steam in creating draft was Timothy Hackworth.

The author is evidently a little confused concerning his facts about who deserve most credit for the development of the English locomotive, for in another part of the book he says: "The blast pipe of Hackworth, the tubular boiler of Seguin and the link motion of Stephenson constitute the essential features of the modern locomotive engine."

Here again he is unjust to his own countrymen, for Peter Cooper used a tubular boiler on the Baltimore & Ohio at the time Stephenson first applied it to the "Rocket," and Cooper's "Tom Thumb" engine was the first of an unbroken line of American-built locomotives that had the tubular boiler, which was patented in 1791 by Nathan Read, a Massachusetts man. It had been used to some extent for steamboats in American waters, and was familiar to Americans long before Seguin paid any attention to steam boilers.

Crediting Stephenson with the invention of the link motion is a dubious compliment, for it is well known that the inventor was William Howe, a draftsman in the Stephenson works. George Stephenson did not even deserve the credit of adopting the link, for that was done by his son Robert.

These criticisms may appear trivial, but they are really of great importance, for they stand for truth in history, which ought not to be impaired by careless statements.

To attempt a bare description of what the book contains would be beyond the limits of our space. The first eighty-one pages contain a philosophical history of the steam engine and bring the reader along from Hero's engine, described 120 years before the Christian era to the present time with the quadruple expansion engines and other modern refinements. It follows the gradual rise of steam boiler pressure from about 5 pounds above the atmosphere in 1800 to 300 pounds in 1900 and discusses the resulting changes. In this connection we note that the Newcomen atmospheric engine which Watt improved into the steam engine raised 105,000 pounds of water 1 foot per pound of coal burned in steam making. Smeaton by improvements on Newcomen's engine increased the duty to 120,000 foot-pounds. Watt started with an efficiency twice that of Newcomen and raised it to 320,000 foot-pounds per pound of coal with a steam pressure of about 10 pounds above the atmosphere. The highly developed steam engine of to-day performs a duty of raising 1,500,000 foot-pounds or more to the pound of coal used.

That really embraces the whole story, and the other parts of the two volumes are devoted to describing and discussing the improvements which have brought about the magnificent results described, and in speculating on the future improvements that will take still more useful work out of each unit of heat.

In connection with the broad history, exhaustive details are given about numerous special engines, such as the marine engine, the locomotive, portable engines, fire engines and all sorts of engines that produce power through the medium of steam. The treatment of these special forms sometimes constitutes a fair sized history in itself. In other cases the description is brief, striking and luminous, as in his remarks on steam turbines. Here we quote, in part: "The introduction of the various applications of electric energy has led to the development of the whole class of 'high-speed' engines. Among these is the steam turbine. . . . . .

"It is an interesting and curious fact that this earliest of all steam engines, antedating Watt nearly 2,000 years, should have as high an ideal efficiency as the best of modern engines. . . . .

"The speeds of the steam turbines enormously exceed those of any form of engine with reciprocating piston, or even of the so-called rotary engines. The three and four cylinder engines of the Brotherhood type, in which the several cylinders are usually grouped radially about a common crank and shaft, often exceed 1,000 revolutions per minute and have been driven, experimentally, about 2,000; but the steam turbine of Parsons makes 10,000 and even 20,000 revolutions, and the Dow turbine is reputed to have attained 25,000."

The vast amount of information which this work contains concerning heat, steam and the steam engine will make it as good a library of reference for students and writers about the steam engine.

Electricity in Railroad Shops.

Electricity as a motive power for shop tools has won its way to the front very rapidly in the last few years, and this not only in the installations of new shop plants but in the re-arranging of old ones to meet the new conditions which are so forcibly demanding that work shall be turned out on a basis that would not bankrupt a contract establishment. Railroads are rather more prominent in this direction than private concerns, contrary to the usual order of things.

Among the roads entering into this spirit of improvement is the Northern Pacific, which is spending a whole lot of money at this time in enlarging their shops at Brainerd, and also at Como, St. Paul. The Brainerd shops were considered a very extensive and up-to-date plant when built a few years ago, with a fifty-two-stall roundhouse and locomotive and car repair shops, but the immense equipment now owned by the road soon demonstrated that the shops on the line were totally inadequate to the demands of repair work, much less new, and the work of extension was at once started.

The capacity of the Brainerd shops will be practically doubled, while that of the Como shops will be increased so as to take care of the repairs and new work for many years to come. Electricity is going into both of these plants as a tool drive to an extent that would astonish most engineers a few years ago. It is no experiment now, and the officers of the road are putting in the improvements with full confidence in the results.

Cylinder Retrospect.

During 1901 we illustrated the Cleveland engines, a machine with some peculiarities of design in the cylinders, which it will be remembered were about 85 per cent. longer than the ordinary cylinder; a length made necessary to provide for the central exhaust, which in connection with the annular exhaust pipes were the factors which the inventor claimed would cause an overturning of existing records of economical locomotive performance.

An order for twelve of these engines was placed, and six were built—five consolidation and one ten-wheel—and placed in service during the summer of 1901. Six ten-wheelers remained to be built, to complete this lot, when the railway company ordered the engines to be changed into ordinary cylinder with piston valves.

It would be interesting to know something about the forces at work to produce this revulsion of feeling concerning the value of the Cleveland idea. Several of

the engines have been at work for some time—long enough to demonstrate what there is in the scheme—but no tidings ever reached the outer world as to fuel economy, and the inference is a natural one that these cylinders require as large an amount of steam to produce a horse-power as any of the older, well-tried devices.

Simple justice to the old plain cylinder prompts the statement that when it is accompanied by a properly designed valve motion, it approaches quite near the lines defining economical work in locomotive engineering, and has made the fact very plain, that any further economy to be attained by the locomotive must be had by compounding.

Items From Editor's Note Book.

In our January number we published an item to the effect that inquiries had come to us about a reported correspondence school which was aid to be located at 304 Broadway, New York. Our correspondents complained that they paid the school fees expecting to receive the entire course which they had paid for, but that they received only one or two papers and that letters of complaint and protest do not bring any answer. We believe that there are several correspondence schools that are simply obtaining money under false pretenses. We can do nothing for a person who has been victimized, but we can give valuable information to those who are thinking of joining such a school. When you are importuned to take lessons from a a correspondence school that you are not certain is a genuine educational institution write to Railway and Locomotive Engineering for advice. It costs you only a two-cent stamp.

Many railroad companies that are paying out thousands upon thousands of dollars annually to repair avoidable trains wrecks are "considering" the advisability of introducing the block signal system which keeps trains apart. A well-known goal of procrastination is said to be paved with good intentions. Act, act in the living present.

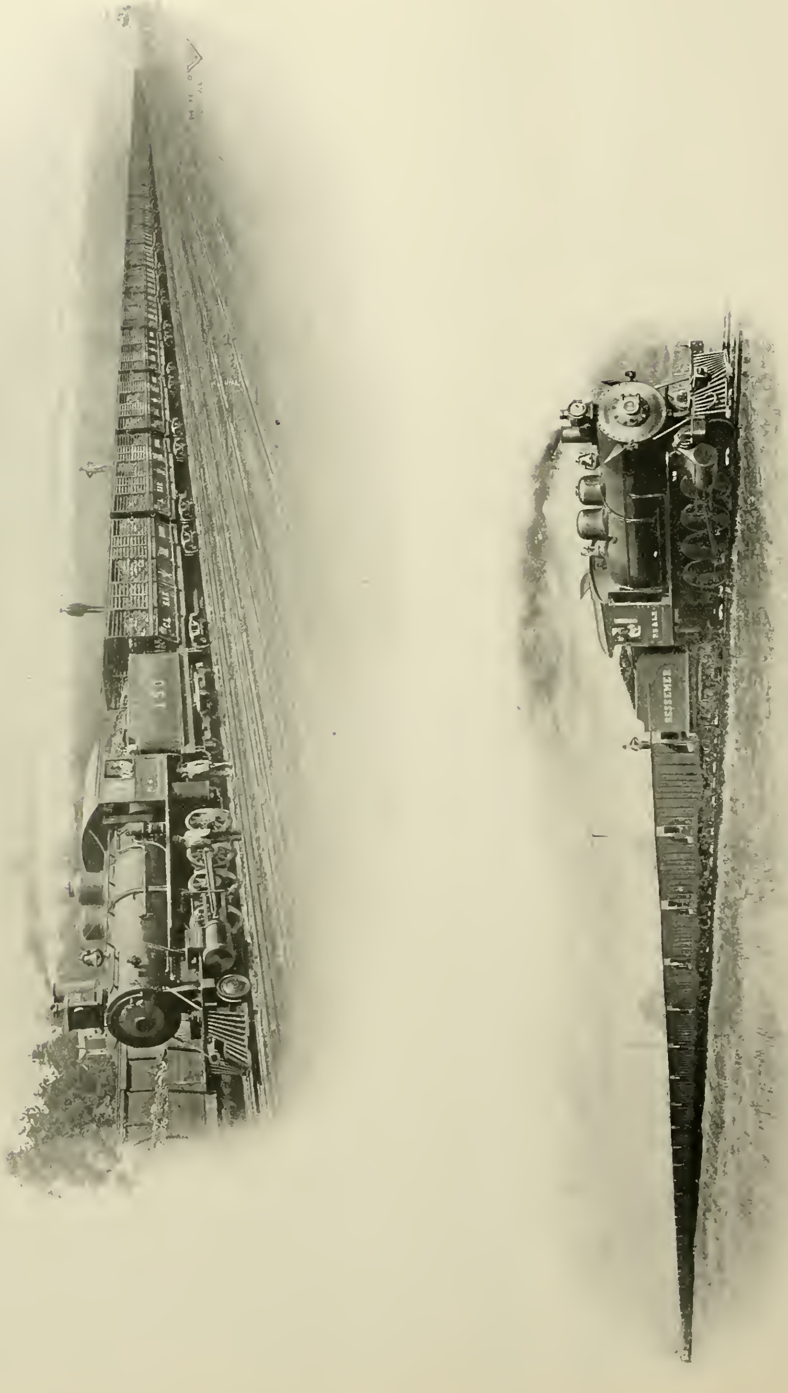
The railway companies that use car door-closing cylinders may not earn any increase of revenue from the use of these comfort-inspiring devices, but they prevent annoyance to nervous travelers, especially to women, which certainly has a money value. Some car doors require a hard slam to close, and vigorous brakemen do not spare their muscle, so the door is closed with a clash that sounds like the noise of a Fourth of July cannon. This becomes a real source of annoyance on suburban trains where doors are opened frequently. I have seen nervous ladies in these cars start every time the door was closed and shrink as if they had received the cut of a whip. I do not see why sliding doors like those found on nearly all trolley cars are not employed on steam road suburban cars.

There is something incongruous about the appearance of some of our most luxuriant appearing trains. All that art, skill and the lavish expenditure of money will effect has been done to make the cars look handsome inside and outside. The finest paint and varnish make the outside beautiful and industrious hands are kept busy at every terminus to impart perennial brightness by wiping and washing away the stains and grime of long journeys. One with a taste for the beautiful passes along the platform filled with admiration for the cars individually and as a whole train and then he comes to the engine and beholds a huge black machine enveloped in grime, dirt and grease. In many cases the appearance of the engine suggests the necessity for using a hoe to scrape off part of the dirt covering. It is different on foreign railways. There they aim to make the locomotive look as attractive as the cars. I have noticed that the Chicago & Alton Railroad try to make the appearance of train and locomotive harmonize. Their trains de luxe are strikingly handsome and finished in tuscan red. The tender, cab and other leading parts of the engines that haul these luxurious trains are painted and varnished in colors that harmonize with the appearance of the cars. I commend an examination of the effect, to such enterprising stimulators of travel as George H. Daniels

One of the pleasantest surprises I have had lately was the information that my old friend, Waldo H. Marshall, had been promoted to the position of general superintendent of the Lake Shore & Michigan Southern Railway. Mr. Marshall is about the most popular man of my acquaintance and always has been a favorite with everybody in the various positions which formed the steps to his newly attained altitude. It seems to have been but very few years since he appeared in the railroad journalistic world in Chicago fresh from the sea breezes of Rhode Island with striking rosy cheeks and an alluring personality that attracted hosts of friends. His preliminary railroad training was rather extraordinary, having been acquired in investigating railroad problems and railroad machinery for the purpose of writing about them. He enjoyed the benefit of a machinist and draftsman experience acquired in the Rhode Island Locomotive Works, which formed a good foundation on which to build a sound engineering career. It was not till 1897 that he entered railway service as assistant to Mr. Robert Quayle, superintendent of motive power of the Chicago & Northwestern. A year ago he was chosen superintendent of motive power of the Lake Shore & Michigan Southern, and behold how quickly he has commended himself for a higher position. He is only thirty-seven years old and has a good start for becoming railway president before he staggers under the burden of years. Every apprentice or novice entering railroad work has the same opportunities before him that Mr. Marshall has enjoyed. It is not stretching the field of possibilities to say, "Go thou and do likewise."

Some cynical philosopher says that if you desire to incur the common man's enmity do him a favor. That is rather a low sentiment, but I wonder sometimes if it does not apply to some of the efforts I have made to help men to the means of bettering their conditions in life. I have for years kept a list of men who were looking for higher positions in railway life and have recommended some of them when openings occurred. The impr ssion is gaining on me that the good intentions thus manifested have brought me more enemies than friends. I recently agreed to help a railroad manager to obtain some engineers to work on a Central American railroad. Among those who called at this office to ask about the job were some engineers who talked very indignantly because the positions were not in New York State. They talked as if the paper was used as a medium of false pretenses by inducing them to come to New York to apply for a position they would not accept, all this after the notice had plainly stated that the positions were in Central America. One time I recommended a master mechanic who was out of a job to a good position which he secured. A year or two later another position was open and this man wanted it and asked me to help him. I had already recommended another man and declined to help the party of the first part. He took offence and has always talked disparagingly of me ever since.

Every time that I go upon a journey, I receive cause for wondering at the marvellous conservative tendencies of some railroad companies in the way they supply water to locomotive tenders. When a train can stop with the tender opposite the water tank they generally take a supply expeditiously enough, but when they have to take it through a water column there is annoying loss of time through the small capacity of the stand pipe. It is a very common thing for fast heavy trains that have all they can do to make running time, to lose three or four minutes at every water station through the slow operation of the antiquated apparatus that was designed for conditions existing two generations ago. The increased height of tenders has aggravated the inefficiency of ancient water columns, since in many instances the latter have been spliced to reach the required height, and the splicing throttles the flow which was too slow originallly. If railroad companies would figure a little on the increase of coal consumption that goes on daily by the engines being pushed to make up time lost through the inefficient water column, there would be a rush for modern appliances which would strain the capacity of all places where these things are made.



TWO MODERN TRAINS—PRESSED STEEL CARS.

Piston Valves.

The use of the piston valve in locomotive work is not as modern as many seem to think, having been used as long ago as 1833 on the "Earl of Airlee," built by Carmichael, of Dundee, for the Dundee & Newtyle Railroad. Since that time there have been numerous revivals at various periods, but, like some vaccinations, they did not seem to "take," until within the past few years. Whether they became a fixture and forced the "D" slide valve to the "Field Museum" remains to be seen, but there are many now in use, and it is the present we have to deal with.

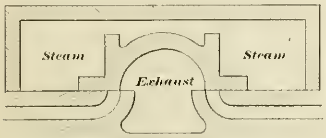


FIG. 1. PLAIN D-VALVE.

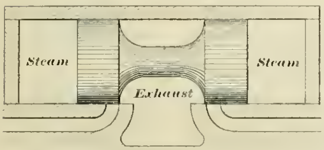


FIG. 2. PISTON VALVE—OUTSIDE ADMISSION.

Judging from letters we receive, the compound locomotive and the piston valve have taken the mysterious places that were formerly occupied by the injector and the air brake. It seems best, therefore, to show, by a few simple drawings, what the piston valve is and how it differs from the "D" valve with which all are familiar.

In Fig. 1 is shown a plain "D" slide valve in its central position, witn the exhaust cavity "line and line" with the ports and a liberal lap on the steam ends. The amount of lap is not under discussion and is of no consequence to us at present.

In each case note carefully whether the steam is admitted to the cylinder by the outside or inside of valve, as this is of vital importance in setting valves. In Fig. 1, as in all "D" valves in use on locomotives to-day, the steam is admitted to cylinder by the outside edge of valve.

Fig. 2 shows a solid piston valve which also admits steam from outer end, and is therefore identical in action with the slide valve shown in Fig. 1 The setting of these valves would have to be the same, although performed somewhat differently, owing to difference of construction.

Fig. 3 shows a solid piston valve with inside admission and outside exhaust. The steam pipe must supply the chest between the heads of the valves and the exhaust be taken out at both ends. The proportions in this figure are not such as are used. The idea is shown as nearly like a "D" valve as possible, so that there will be no difficulty in understanding the difference between them. To show this more clearly, Fig. 4 shows a "D" valve with inside admission. A top plate is added to prevent the live steam under valve from lifting it off the seat. The ports are spread or shortened and the clearance or volume of the ports correspondingly reduced. This valve would have to be set the same as the one shown in Fig. 3.

Some builders using piston valves admit steam at the ends the same as a "D" valve, among them being Baldwin in the Vauclain compound. This is a double valve controlling both high and low pressure cylinders and acting as two "D" valves. This is clearly shown in Fig. 5, where the live steam comes in at the ends, is admitted to high pressure cylinder through the right-hand port. At the same time the exhaust from the high is flowing out the left port, through the center of valve to the low-pressure cylinder, while the low-pressure exhaust, flowing out of other port, goes direct to the stack.

Whether the admission is at center or at ends, the builder of piston valves makes them much longer than shown in the previous sketches, in order to make the ports leading to cylinders as short as possible.

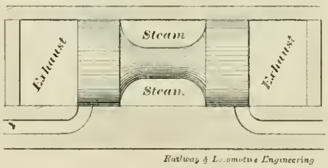


FIG. 3. PISTON VALVE—INSIDE ADMISSION.

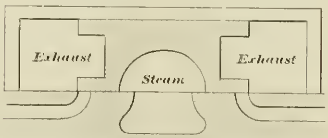


FIG. 4. D-VALVE—INSIDE ADMISSION.

Fig. 6 shows a modern piston valve with outside or end admission, having the same action as a "D" valve of the same dimension and made hollow for lightness. The steam is free to pass from end to end, but this does not affect the working in any way. In this, as in Fig. 7, a single, broad packing ring is shown at each end. This is not often used, however, but serves to show that in setting piston valves we must consider the edge of the rings as the end of valve instead of the valve body itself. It is the ring or rings which govern the admission and exhaust of the steam, and not the body of valve.

Fig. 7 shows the same valve as Fig. 6, except that it has inside admission such as is commonly used. Fig. 8 shows an internal admission valve partly open to admit steam to left-hand port while the right port is open to exhaust.

Ideas vary greatly in regard to packing rings, and they abound in great variety. The left-hand sketch in Fig. 9 shows a method used to some extent, consisting of a "bull ring" *B* which carries two packing rings *A A*. These are locked into *B*, as shown, which effectually prevents them springing out too far. As will be seen, the bull ring is held in place by the follower *F* being bolted to body casting *C*. These can be so made that both the bull and packing rings are free to move, or the bull ring could be clamped and the rings free to move. Some valves—especially in marine service—have the rings so made as to be locked in any desired position, making it virtually a solid valve. After they wear sufficiently to warrant it, the follower is loosened, the rings expanded as much as desired and again locked into place. This has all the advantages of the solid valve (except first cost) and also of being adjustable for wear. The right-hand sketch shows a hollow valve with a cast body *V* carrying two spring rings *R R* at each end.

Probably the first reason for adopting piston valves was to get away from the balancing of the slide valve. As will be seen in Fig. 1, the full pressure of steam is forcing the "D" valve to its seat and causing friction if it is moved. In Fig. 2, on the contrary, the steam is acting against each end, while in Fig. 3 the same principle holds good, being applied in center instead of at ends. In neither of these have we shown any valve rod, but it can be readily seen that a valve rod at one end will unbalance the valve by decreasing the pressure on one end by the amount due to the area of the rod. In some cases this has been balanced by putting an extended valve rod out the other end, but this introduces another set of rod packing, which is not altogether desirable.

The steam pressure being balanced, the only resistance to motion is that due to its weight and the friction caused by it. When

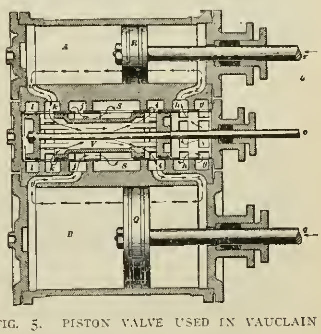


FIG. 5. PISTON VALVE USED IN VAUCLAIN COMPOUND.

spring packing rings are used, however, an element of friction is introduced, the amount depending on the construction of the rings. In some cases this has amounted to more than the friction of a slide valve and indicates clearly that piston

valves are not necessarily frictionless. In nearly all constructions the steam works its way under the rings by hook or by crook and helps along the cause of friction.

The question of admitting steam at the ends or the center of a piston valve seems to have settled down to the latter in most cases. This has the advantage of having the most of the cooling surface of the valve chamber come in contact with exhaust steam, and the more valuable advantage of only having to pack valve stems against exhaust pressure. This is of considerable importance where high steam is used. There is still another advantage in making the joints with the heads of the valve chest, as the pressure is so much lower. In the case of a slide valve and steam chest it is still more important.

So far nothing has been said regarding the movement of piston valves or the difference in this respect from the "D" slide valve. When a piston valve admits steam from the outside—as does the one shown in Fig. 2—its movement is the same as that of every "D" slide valve in common use, and it is set in the same manner. But when the steam is admitted from the center or inside the motion is just the reverse. This can be readily seen by studying Figs. 1 and 3 very carefully, or perhaps Fig. 8 would be better, as that is partly open.

In order to open the left steam port, the valve in Fig. 1 must move to the right, while the inside admission valves 3 and 8 must move to the left or in the direction of the port it is to open. Valve 8 is already half open and steam is following the arrows shown. This opposite movement of the valve is one of the things that puzzle a man who has always been used

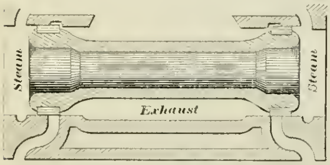


FIG. 6. LONG PISTON VALVE WITH OUTSIDE ADMISSION.

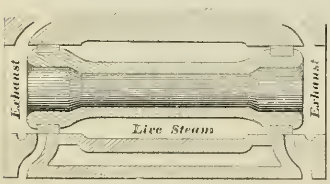


FIG. 7. CENTRAL ADMISSION.

to the "D" valve, but if he will give it a little attention there need be no difficulty.

This opposite motion can be obtained in two ways—by placing the eccentrics on the axle opposite from the usual position or by doing away with the rocker arm and connecting the valve rod direct to link block or a connection from it.

Fig. 10 shows the regular link motion in plain outline. The eccentrics are shown on axle and the crank pin is moving down as shown. This gives the lower end of rocker the motion indicated by arrow *A*, which is transferred at upper end to *B*. This would admit steam to right-hand port with an outside admission valve, regardless of whether it is of the "D" or piston variety.

Fig. 11 is the same valve motion with rocker removed and the motion transmitted direct, instead of being reversed as in Fig. 10. The valve rod can be supported as shown, by hanger *H* in dotted lines or in any other way desired, so long as the direct motion is not interfered with. A little thought will show that this motion would open the right-hand port of an *inside* admission valve, making this a good form for a valve of this kind, and explaining why many piston valve engines

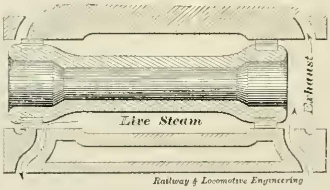


FIG. 8. CENTRAL ADMISSION PARTLY OPENED.

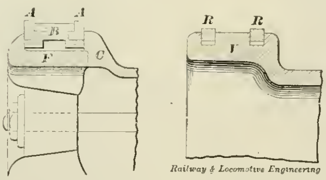


FIG 9. TWO STYLES OF PACKING RINGS FOR PISTON VALVES.

have no rocker arm. This is better in some ways than using the rocker arm and reversing the eccentrics, although the general design of the locomotive sometimes determines which is best to use in that particular case.

Fig. 12 shows the regular link motion with rocker, but with eccentrics moved halfway round the axle or opposite the crank pin. As will be seen, this would move lower end of rocker as shown in arrow *A* and upper end like *B*, giving same movement to valve as Fig. 11.

These three figures, 10, 11, 12, will be of value in determining what kind of valves we are dealing with, and are more convenient than to take them out for examination. First note the relation of the crank pin and eccentrics. If they are together or on the same side, as in Figs. 10 and 11, then see if the motion is direct or reversed with a rocker. In fact they may be summed up in three little rules or statements:

If the eccentrics and crank pin are together and there is a rocker arm which reverses the motion, the valve has outside admission (see Fig. 10).

If the eccentrics and crank pin are together and there is no rocker arm but the

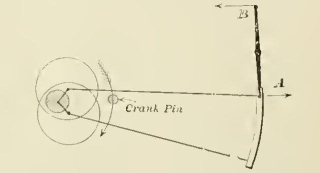


FIG. 10. REGULAR INDIRECT MOTION WITH ROCKER.

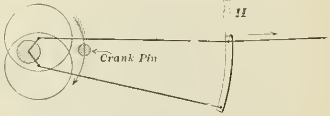


FIG. 11. DIRECT MOTION—NO ROCKER.

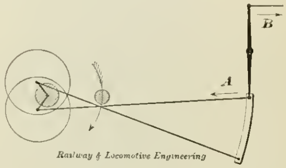


FIG. 12. "CROSSED" RODS WITH ROCKER ARM.

motion is direct, the valve has internal or central admission (see Fig. 11).

If there is a rocker arm which reverses the motion but the eccentrics and crank pin are opposite instead of being together, the valve has internal admission (see Fig. 12).

So if you look your engine over and note the relative positions of the crank pin and eccentrics and get a good look at the rocker, if there is one, you can tell whether the valve is central (internal) or outside (end) admission. Knowing this, you also know what to do should anything happen that made resetting necessary.

Valve setting on the road is a thing of the past (except in rare cases)—the first thing being to clear the right of way—but it is well to know how to go to work if necessary, and the first thing is to know what kind of a valve you have to deal with. A rough rule, and one which will get you home or out of the way of other trains, if it's only a case of slipped eccentric, is to set the eccentrics as indicated on the clock dials shown in Fig. 13. For valves with outside admission with a rocker or valves with inside admission *without* a rocker, use clock *A*, which shows the crank pin at 3 o'clock and the eccentrics at 1 and 5 o'clock with rods *open*.

For inside admission valves with a reversing rocker, set the eccentrics as shown

in *B* with crank pin still at 3, but eccentrics at 7 and 11 and rods *crossed.*

THE "AMERICAN" PISTON VALVE.

The endeavor to produce a piston valve with expanding rings and yet have the advantages of a solid piston valve, led the American Balance Slide Valve Company,

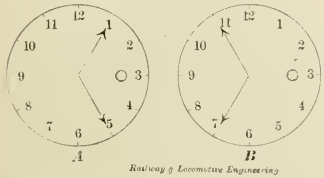


FIG. 13. ROUGH VALVE SETTING.

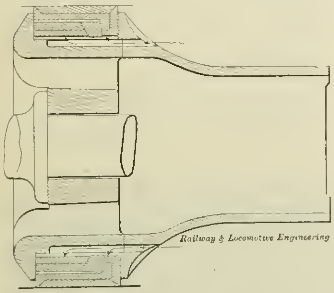


FIG. 14. "AMERICAN" ONE RING COMPLETE.

of Jersey Shore, Pa., to design the valve shown with this. The makers term it a "snap ring plug valve," on account of the locking of the rings by the pressure after being expanded into place. The sketches, Figs. 14 and 15 show the ends of a valve, one fitted with a wide ring, the other with two narrow rings. Figs. 16 and 17 show enlarged details of the same, and these will be referred to in explaining their action.

This valve has internal admission, and, as will be seen, the steam is also admitted under the rings. Ring 1 is the snap ring, and is in three sections in Fig. 11, the joints being lapped to prevent leakage. Ring 2 is solid—that is, does not expand with the steam. Ring 3 is split and is called the wedge ring.

Steam being admitted to chest, it goes under the rings 1, expanding them against cylinder walls. At the same time wedge ring 3 is forced against solid ring 2, which locks rings 1 against head of valve and prevents any further tendency to expand; so that it is in effect a solid valve. The action is similar in the double ring valve, Fig. 16. There are two snap rings 1, 1, two solid rings 2, 2, and one wedge ring 3. Steam acts just the same as in the other case and locks the snap rings solid with the valve. As will be seen, a follower plate is used on each end.

When an engine is running without steam, the rings are not held against the valve bushing, but give relief while drifting by giving a free opening past the valve rings. A number of these valves are already in use and giving good service.

It seems to have the good points of both the solid and snap ring valve, as well as the additional merit of relieving an engine while drifting.

Objecting to Progress in Locomotive Designing.

There used to be a joke made at the expense of the shipbuilders of Maine, to the effect that they were in the habit of building a ship a mile or two long and then cutting off a piece to suit the requirements of purchasers. That would be pushing the desire for uniformity of design to its utmost limits. We have often thought about that joke when we have heard the question dinned into the ears of railroad motive power men, "Why don't you settle upon a few designs of locomotives and enable builders to make them according to settled patterns?" There was no use to argue against the fallacy of finality or the

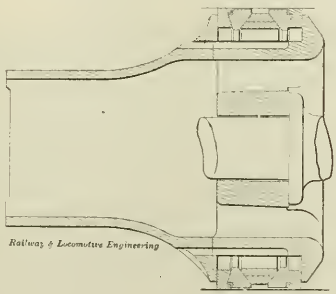


FIG. 15. "AMERICAN" TWO RING COMPLETE.

Chinese method which railroad men have been urged to adopt. The class is too enterprising to need caution against progressive tendencies. It will take many years' longer experience to convince them that it is time to stop making changes or to conclude that no more improvements are possible.

A sensible talk on this subject was given by George W. West at a recent club meeting. He said:

"First of all I want to thank Mr. Vauclain for the compliment he paid the motive power men of the country, in the statement that he seldom got two orders alike from his different customers, and furthermore that the same customers seldom duplicate the engines which they have ordered. I consider this a very great compliment. It only shows the progress of the motive power department, and I feel quite sure that if in ordering engines in 1901 for the Ontario & Western I had ordered duplicates of the engines that we ordered in 1890, eleven years ago, I would not be superintendent of motive power today. We built twenty-five engines in 1890, with fireboxes 8 feet wide and 10 feet long, and those engines were in service about two years. During that period our general manager had asked me several times how the engines were doing, and I had said, 'All right.' One day he told me he had given the builders orders for twenty-five more. I said, 'I am sorry, because there are a few changes I wanted to make on those engines.' He said, 'You told me several times those engines were all right.' I said they were practically all right, but there were a few little changes I would like to make. It ran along three or four years, when he said to me, 'I am going to have some more engines built, and before we give the order I want to know whether the engines are all right.' I said, 'No, we want to make a few more changes.' He said, 'Are you ever going to get through making changes?' I said, 'No, I hope not.' It seems to me we cannot do anything else than make changes. The demands of the times require it. The first twenty-five of those engines have been in service eleven years, and last year was the first year we put any new fireboxes in. They were in constant service ten years, while engines with narrow fireboxes that came on the line at the same time have had one new firebox and some two. We have had less trouble with staybolts; hence I think they are not only an economical engine, but an engine you can rely on every day."

The site on which the Structural Steel Car Company, of Canton, Ohio, intend to build has been mapped out, and just as soon as weather conditions will allow work will be rapidly pushed forward. The officers of the company are: Elwood C. Jackson, president; Henry A. Cavanah, vice-president; A. S. Griffin, secretary and treasurer; W. H. Woodcock, general superintendent; R. H. Hoenbrook, mechan-

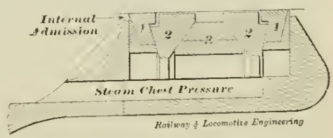


FIG. 16. "AMERICAN" ONE RING—DETAIL.

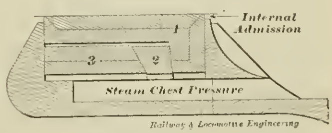


FIG. 17. "AMERICAN" TWO RING—DETAIL.

ical engineer, and John R. Reed, general manager. They have a temporary office in the City Bank Building of that city.

H. E. Greenwood resigned the management of the Newark works of the Westinghouse Electric and Manufacturing Company, taking effect February 1st.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air-Brake Association Convention.

The ninth annual convention of the Air-Brake Association will be held in Pittsburgh, Pa., beginning Tuesday, April 29th. The committee on arrangements have not yet completed their work, but thus far promise an exceptionally good programme of entertainment to the members and their ladies. The opportunity to visit the shops of the Westinghouse Air-Brake Company, the Pittsburgh Locomotive Works, the Pressed Steel Car Company and the large steel works and glass houses of the Smoky City, should not be cheaply held or neglected. Our next month's issue will contain the full details as arrived at by the Committee on Arrangements. Every member should be in attendance for his own good as well as for the good of his company. Make application at once through the usual channel for transportation, and make every effort to be on hand when the president's gavel drops.

Death of Prominent Air-Brake Man.

J. V. Murray, traveling air-brake inspector for the Westinghouse Air-Brake Company in the Republic of Mexico, died quite suddenly and unexpectedly from the effects of an internal surgical operation in a Chicago hospital, Wednesday morning, February 12th. From the Burlington road Mr. Murray entered the Westinghouse Air-Brake Company's employ, going direct to Mexico, thence to South America on the Lima Railways, Lima, Peru. Returning one year later to Mexico, he became very active in instruction work on the Mexican National. Despite the enervating effects of the unhealthy climate, he persisted in finishing the work he had begun, but was finally obliged to give in to the first serious illness of his life. He came North to recuperate, but met with indifferent success, finally succumbing to an operation, as above noted. Although Mr. Murray was one of the most recent acquisitions to the Westinghouse Air-Brake Company's inspectors' force, his many sterling qualities quickly won for him a high and respected place with his officials and among his associates, as well as with those with whom business brought him in contact. His death is deeply regretted by all who knew him.

Air-Brake Association convention people will be grieved to learn of the death of Mrs. C. G. Greene, who, with her husband, has been a regular attendant of the conventions since the inception of the organization. She died in Indianapolis, February 9th.

CORRESPONDENCE.

Colorado Midland Air Brake Testing Cart and Day Testing Crew.

Having seen the Southern Pacific testing cart in the December number, I thought I would send you a picture of my "go-buggy," as the enginemen call it, also the day air gang at Colorado City. It will be seen that the air enters in at one handle and goes out the other. I use a governor for reducing the pressure, as our pressure is often upward of 100 pounds, and it fills the bill pretty well in the absence of a slide valve feed valve.

W. L. Marcraft,
A. B. Insp., Colo. Mid. R. R.
Colorado City, Colo.

COLORADO MIDLAND AIR-BRAKE TESTING CART AND DAY TESTING CREW.

Freight Train Inspection and Air Pumps

There has been a great deal said and written about the inspection of air brakes at terminal points lately. When a train is broken up for the purpose of setting out and picking up loads, we all know that a terminal test is a necessity.

After the engine is coupled to the train and the train line is pumped up to the required pressure, the brakes are applied by the engineer, who will make a reduction of about 20 pounds. The inspector will make a rush for the rear end of the train, and when he reaches it, will give a signal to release. Then he comes to the engine and notifies the engineer that so many brakes are working, so many not working, and so many are piped cars. No note is made of the piston travel, whether it is 6 inches or 10. A leaky hose coupling or train line, or joints in the train pipe are not thought of, as it seems to be the chief aim of everyone connected with a terminal station to get that train out of the yard as soon as it can be done. The consequences are that the train receives some pretty rough handling in trying to make the stops necessary in getting this train over the division. If it happens to be a train consisting largely of merchandise, and not much attention given to the proper loading of same, the chances are that the freight in some cars will look like it had been in a small cyclone when it reaches its destination.

I am using this preface to show to some extent what causes so much trouble with the average run of air pumps that we find on the freight engines of to-day. If the matter of inspections were given more attention, we would have less trouble with our air pumps. I will admit that most roads, operating over a mountainous country, look to the condition of their air-brake equipment much closer than those where the conditions of the grades do not require the combined use of air brakes and hand brakes.

A few years ago, when air brakes were first applied to freight trains, and there were only a few cars in each train that were equipped with air, it did not make so much difference, as the number of leaks were few, and in those days the brakes on the engines were kept up in better condition than they are at the present day. But the conditions now are entirely different, as most trains are all air braked, and where

we then had a few cars we now have thirty or forty. We are all aware of the fact that when the brake pistons travel from 6 to 10 inches, a slight reduction of, say, from 6 to 10 pounds, is not very effective, on account of the expansive force being weakened by excessive travel of the pistons.

You may take a freight train going at a speed of 30 miles per hour, and make a reduction of 10 pounds, and you will reasonably expect to feel the train retarding in speed, but with the general run of freight trains, under the system of loose and hurry-up inspection, nothing of the kind happens. Instead, the train seems intent on running that much faster, and before that train is stopped you will notice that you have used up all the air that you can exhaust from your train line. If the train is stopped too quickly, or not quickly enough, you will find that it is necessary to stand and pump up, or run the chances of running by again. This happens most of the time where no attention is paid to the proper travel of the brake piston, as can be readily seen on our engine brakes.

You can adjust the travel of the brake pistons to 4 inches on driver brakes and 6 inches on tank brakes, and in switching with the light engine the pump will have a comparatively light time in keeping the pressure up, for the simple reason that it takes less air to make the brake effective, on account of short piston travel, by reason of the air not losing its force by too much room for expansion. On the other hand, let the shoes get badly worn, and the pistons double their former travel by this wear, and you can readily see that it takes twice the original amount of air to do the work. This is what causes our pumps to be in the condition that a majority of them are in to-day.

Anyone standing by one of our freight engines, after a train has been brought to a standstill by the air brakes, and listening to the pump trying to pump up the train line to the standard pressure, would think the engineer had the contract of pumping the air all out of the State of Kansas, and was stowing it away for future use somewhere.

I will admit that some of this trouble is due to the men who are handling these pumps, in not giving them the proper attention, by stinting the pumps on oil, and having leaky packing in the air end of the pump. It used to be the supposition that the air pump required very little oil to maintain it, but my observations are that it takes quite a good deal of oil to have it run properly.

I have frequently heard the air pumps of engines that have just come in from road service, groaning and squeaking as if in all kinds of agony. Especially is this true of the air ends. It has been my experience that the air end of the pumps require about as much attention as the steam end, as the air end makes as much fuss from being hot and dry as the steam end.

The different roads are at present being pushed for engines, and it is generally the case that the engine that just comes in is the one wanted to go right out again, and that is another reason why the pumps are not taken better care of when a division is short of motive power, and engines are wanted to go out as soon as they get in. And when different men are put in charge of engines, we all know that the power degenerates, unless the engines are given a rigid inspection and the work kept up on them.

But closer inspection of our freight cars, in regard to the brakes, will remedy a good many defects of our air pumps which are caused by running them at a race-horse speed in trying to maintain the pressure requisite to the safe handling of our freight trains. E. S.

Neodesha, Kan.

Air Brake on a Brass Lathe.

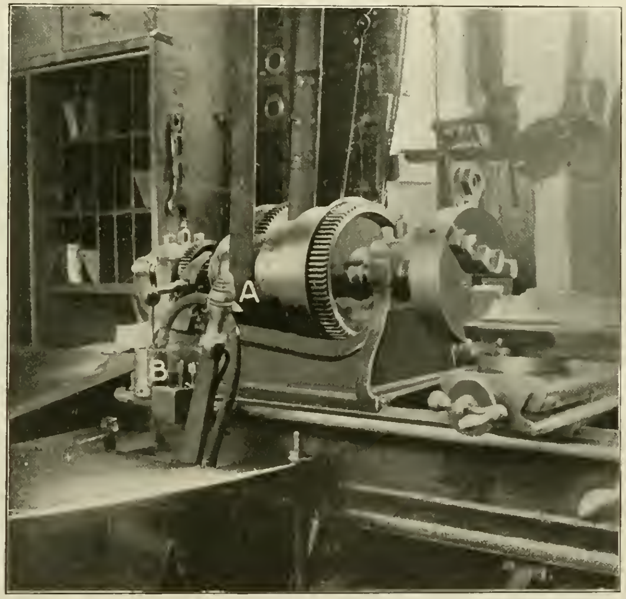
I enclose under separate cover a photograph of something new in the air-brake line. While this brake does not pertain to cars or locomotives, it will, nevertheless, be of interest to anyone interested in machine tools, etc.

The brake referred to is applied to a regular brass-working lathe, the brake valve being attached to the shifter lever. This shifter is worked forward and back to start and back up the machine, the center position being the stop. When the operator stops the machine, he turns the brass valve about one-eighth of a turn, which connects the feed port with the brake cylinder by means of a rubber hose This stops the machine at once.

The brake, marked *B* in photograph, is of the ordinary band variety, and grips tight enough under ordinary conditions to permit the operator to screw off or on nuts, parts, etc., usually machined on screw chucks. This saves putting in the back gear for this purpose.

Under ordinary conditions, when machinery of this class is stopped, it continues to run for some time unless stopped by using the hand as a brake. With this device the machine is stopped at once without the least effort. It will not be necessary to add that this device is considerable of a saver of time, and time of course means money. ALFRED MUNCH.

St. Paul, Minn.



AIR BRAKE ON A BRASS LATHE.

To Purge Main Reservoirs.

Several years' experience on air brake repair work has led me to say something in regard to the care of main reservoirs. The air cylinder of the pump is oiled and should be. Some get too much and some not enough. When there is just sufficient oil in them for lubrication, the dust and dirt are drawn in through the air strainers, absorbing the oil and forming a thick, gummy substance which sticks to the cylder heads and clogs up the air ports. When the pump has too many leaks to supply, or the cylinder packing gets worn, it runs hot. Then this mixture of oil and dirt is loosened and forced through the discharge pipe into the main reservoir.

After an engine has been in service a

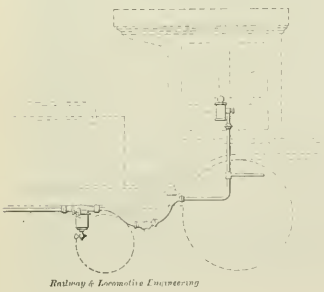
number of years, and several pumps removed on account of being worn out, there is an accumulation of dirt which cannot be very easily removed through the ¼-inch drain cock. When the engine is coupled to the train and the brake valve placed in full release, train line and main reservoir are brought in communication. This dirt is drawn into the brake valve, triples, pump governor and feed valve attachment, interfering with the proper working of these parts, causing the overcharging of main reservoir and train line, and perhaps adding a few slid-flat wheels to the list.

Do not understand me to be making an argument against oiling the air cylinder of the pump, or that keeping main reservoir clean will be a cure for all the ills of the air-brake system; but by placing plugs or suitable openings in them for the purpose of cleaning, I am sure better results will be obtained from the working of the whole air-brake apparatus.

M. R. Wentz.
Air Brake Repairman, N. P. Ry.
Missoula, Montana.

The Morrison Automatic Air Safety Valve.

This is a device for attaching to locomotives and cars in connection with exist-



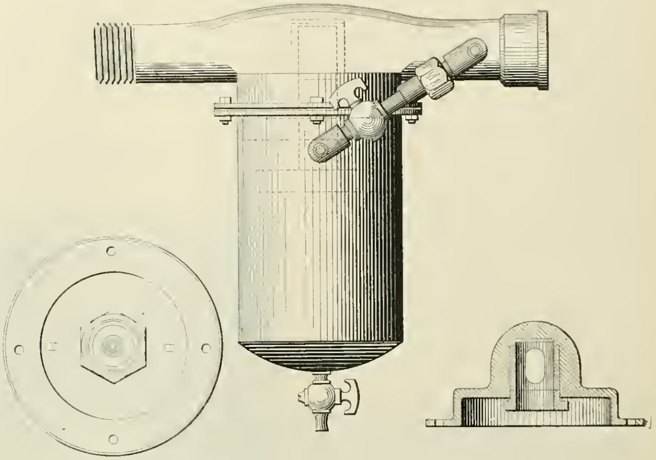
ENGINE- ARRANGEMENT OF MORRISON AUTOMATIC SAFETY VALVE.

ing air-brake systems, for the purpose of automatically controlling the train line pressure when same is accidentally applied by reason of burst hose or train parting.

The purpose of the Morrison automatic air safety valve is to obviate all such casualties and damage by causing the rear section of the train to be brought to a gradual stop and at the same time allow the front section to be in perfect control of the engineman, which will permit him to advance far enough so that a collision will not take place between the two sections.

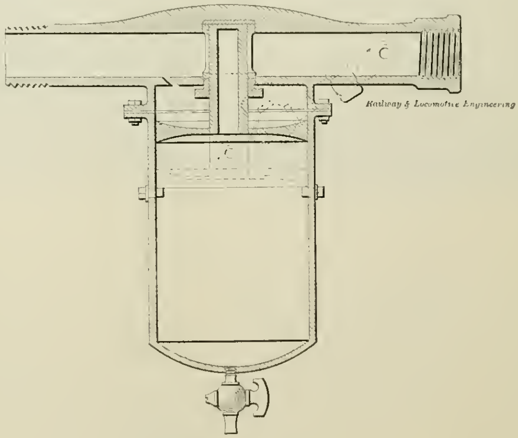
The drawings illustrate a longitudinal section view, showing the movable piston and stem in their normal position with stops on inner wall of cylinder, which limit the downward movement.

When the engineman admits the air into the train pipe, it will flow to the enclosed chamber above the piston, and as the piston has no packing, the air will pass between it and the wall of the cylinder and fill the lower chamber, producing equal pressures above and below the piston.



MORRISON AUTOMATIC SAFETY VALVE.

When the train breaks apart and the hose becomes disconnected, the sudden discharge of air from the train pipe relieves the pressure on top of the piston, forcing the piston upward, in its travel passing the port in the cylinder, allowing the compressed air from the train pipe to pass below the piston, completing its stroke and holding it in position, the stem closing the main pipe line.



SECTIONAL VIEW OF MORRISON AUTOMATIC VALVE.

The air in the train pipe slowly discharges through small hole in the top of the cylinder to the atmosphere, allowing the brakes to be applied throughout the rear section of the train gradually and without shock.

The action of the safety valve at the rear of the front section of the train, acts in a similar manner, but as the train pipe of the front section is in communication with the main reservoir upon the locomotive, the discharge of air through the small holes in the top of cylinder will be replaced and the pressure be retained, and the brake will not be applied until the engineman uses the pressure in the pipe in the regular way.

In coupling the two sections of the train when brought together, the stop-cock is turned, shutting off communication between the train pipe and below the piston, then stop-cock on bottom of cylinder is opened, allowing the air to escape to the atmosphere, whereupon the piston and stem drop to their normal position.

In a service test, made in the Pennsylvania Company's yards, Toledo, Ohio, February 10, 1902, with a train of heavily

laden cars running at a speed of 15 miles per hour, train being broken, the rear section of train came to stop without shock at 200 feet from where the train hose parted, and the front section was under full and perfect control of engineman, the same as though a break-in-two had not occurred. The attachment of these valves on the train pipe did not in any way interfere with or obstruct the free passage of air through the train pipe and subsequent recharging of train pipe system, nor with the proper making of the service or emergency application of the brakes.

This test was made before prominent railway officials and others, who will certify that the valve worked perfectly and performed every claim made by the inventor, Mr. Frank B. Morrison, the Morrisson Air Safety Valve Company.

Toledo, O. T. F. Whittelsey.

Lubrication of Air-Pump Air Cylinders

Air-brake men for some time have realized that air cylinders of air pumps have not been lubricated in the proper manner. The common way of oiling the pumps, through the cock on the air cylinder, proved itself to be inefficient and did not produce as good a result as could be desired. When oiling this way, too much oil was generally put in at one application, and before receiving the next dose the cylinder would become dry, causing excessive wear and requiring frequent boring of the cylinder and renewal of piston packing rings, and all the other numerous evils attending badly worn cylinders and leaky piston packing.

There can be no doubt that the air cylinders of our air pumps, which nowadays are generally worked to their utmost capacity, need constant lubrication in proper quantity. This evil has been successfully overcome by Master Mechanic W. S. Clarkson, of Livingston, Mont., who has applied a lubricator to the air cylinder of the air pump. This lubricator consists of a plunger-feed rod cup, which is applied to the air cylinder, by tapping a hole in the wall of the air cylinder, midway between the top and bottom heads. Into this hole an elbow is screwed, so as to hold the cup in a vertical position. The hole in the wall of the air cylinder, just before reaching the inner surface, is reduced to 1-16 inch.

The feed of the cup is regulated by reducing or increasing the lift of the plunger, which is done by a set-screw in the top of the cup. These cups may be so regulated as to feed any quantity of oil desired. They have been in use on the Montana division of the Northern Pacific Railroad for five months, and have been used on pumps engaged in the most severe kind of service. Examination of the air cylinders has shown that the wear has been reduced to a minimum by a small quantity of oil fed continuously to the air cylinder of the air pump. It is found to be a great improvement over the old way of oiling the air cylinder. This device is simple and inexpensive and results in a great saving to the air pump as well as economy in oil. This may be a device used before, but it has never been brought to my notice.

C. E. Allen.
Rd Foreman, N. P. R. R.
Billings, Mont.

Wrongly Used Triple Valves.

To those who have not seen or handled the new style plain triple valve known as the G-24, it may be of interest to know that they look like the special driver brake triple valve, F-25, and they may easily be mistaken for each other. This has evidently been the case somewhere on the line, judging from the fact that I found one of our new engines, recently from Baldwin's shop, having a 14-inch driver brake cylinder, and was equipped with a G-24 triple valve, which is a mistake, as the 1900 catalogue says plainly that these valves should be used for the following purposes: With 8-inch or 10-inch tender brake apparatus, with driver brake cylinders of 10 inches diameter or less, with or without truck brakes, with plain automatic 8-inch or 10-inch passenger car brake apparatus.

I also ran across a passenger engine with 10-inch driver brake cylinders, equipped with a special driver brake triple valve, which is also a mistake, for if we again refer to the catalogue we will find that this triple valve is to be used with 12, 14 and 16-inch driver brake cylinders, with or without truck brake, and for no other purpose. These valves may be distinguished one from the other in the following manner, without being taken apart. Although the drain cup graduating spring, stem and nut are alike in both valves, the exhaust port in the G-24 valve is tapped for ¼-inch pipe, while the F-25 valve is tapped for ¼-inch pipe. The body of the G-24 valve is smaller, both in height and circumference, than the F-25 valve. On the G-24 valve the plate number G-24 is cast in raised letters on the body, while on the F-25 valve is cast, "For 12 and 14-inch driver brake cylinders."

Vincent M. Hass.
Port Carbon, Pa.

[Our correspondent has made a very important observation. The triples are being wrongly used, and the practice should be corrected at once.—Ed.]

QUESTIONS AND ANSWERS
On Air Brake Subjects.

(133) B. E. L., New London, Conn., writes:

In putting on main reservoir capacity, would you prefer one big 50,000 cubic inch drum (if you get it on) or two or three small ones making all together 50,000 cubic inches? A.—Two or three smaller ones, with as great length of piping between them as possible, thus exposing as much surface of the storage capacity as possible for heat dissipation and cooling of the air.

(134) F. E. H., Binghamton, N. Y. writes:

In the "Standard Examination Questions and Answers on the Air Brake," page 103, Fig. 65, Westinghouse special driver brake triple valve cut is identical with the cut on page 107, Fig. 71, New York special driver brake triple valve. Is this a mistake or are these forms of triples made by these two companies the same? A.—They are the same.

(135) J. R. McJ., Chicago, Ill., writes:

If the rubber packing ring in the hose coupling is worn down so it will not make a good joint with its mate, can't a tight joint be made by reversing the rubber packing ring? I mean that the ring is taken out and laid face down on the coupling, what was before the under side now being made the upper side and joint. A.—A tight joint can thus be made temporarily; but the practice is not a good one, as the loose ring will drop out and become lost when the hose is uncoupled. It will be seen that this practice, if carried to any extent, would create a very undesirable and serious state of affairs.

(136) G. McL., Columbus, Ohio, asks:

Should air come out of both side holes in the New York governor? The machinist says one is for air and the other for steam. Air comes out both of mine, and no steam. Is he right, and if so, why? A.—The upper small release port passes air pressure from the top of the piston to the atmosphere to let the pump start up. The larger, lower port, with a nipple attachment for a pipe, is a waste-away pipe for steam which leaks past the steam valve and for air pressure leaking past the piston packing ring. If no steam leaks away from this port on your governor, the steam valve is either very snugly fitted or is coated with scale.

(137) E. E. C., Aberdeen, S. D., writes:

I would like to know the cause of the trouble we are having with an F-6 brake valve. Put the handle in full release position, and the train line pointer will run up to 110 pounds. Put the handle in running position, and the pressure will go back to 70 pounds. The red hand remains at 90. I think it is the gage. A.—The hands have probably moved on the pinion, thus causing the gage to register wrong. With the pump governor set at 90 and the feed valve attachment at 70 pounds, the pointers should show those pressures in running position if the gage is correct In full release, both hands should register 90 pounds. Have your gage tested with an accurate inspector's gage.

(138) B. E. L., New London, Conn., writes:

If you had three small main reservoirs on an engine, ought they to be all connected together on one pipe and the pump deliver to No. 1 reservoir and the brake valve draw from that same drum? Or should the air go to the first, then to the second and then to third and then to the

brake valve? A.—The latter method is proper and better. The air should be made to circulate through all the reservoirs. The first method has too much non-moving pressure, and hot air delivered by the pump will go direct to the train line without cooling and depositing its moisture, thus defeating one of the prime objects sought by greater main reservoir capacity.

(139) W. A. S., Michigan City, Ind., writes:

I have noticed on all of our locomotives that the train line hose on the rear of the tender has got to be put up in the dummy coupling when uncoupled, and the engineer must put his brake valve in emergency position before the hose can be uncoupled. Almost all roads have angle-cocks in the train pipe at the rear of the tender. Which is preferable? A.—The angle-cock, by all means. Angle cocks, accidentally closed, has prompted several roads in the past to adopt the above scheme, but the cause of the closing should be sought out and remedied rather than discard the angle-cock. A number of roads have, one time or another, abandoned the angle-cock, as above mentioned, but have almost invariably returned to the angle-cock after a little experience.

(140) F. E C., Sandusky, Ohio, writes:

An engineer has a train of four passenger cars. He goes to a certain yard and places one car on a side track, leaving the brake on that car applied by air. Fifteen minutes later a green brakeman gets on this car and pulls the conductor's valve; the brakes release, and the car starts off and runs into a bumper block, demolishing it to splinters. How is it that the brake released on this car when the conductor's valve was pulled open? I always thought that by making a reduction in train line pressure the brakes always applied. A.—The brake was set in emergency application, and doubtless the quick-action valves were stuck open by dirt which worked its way into the triple by the hose dragging. Thus the brake cylinder pressure passed from the brake cylinder through the quick-action valves to the train pipe, thence to the atmosphere, through the open conductor's valve.

(141) F. E. H., Binghamton, N. Y., writes:

In bleeding a brake off that has been set by exhausting all the air from the train line, does not the graduating spring force the triple piston so that communication between auxiliary and brake cylinder is stopped, as soon as the auxiliary pressure is bled below the tension of the graduating spring plus the friction of triple piston? A.—Yes. 2. If such should be the case, how does the air remaining in the brake cylinder get to the bleed cock? Does it raise the slide valve, or does it force the graduating valve off its seat? A.—The slide valve is raised off its seat and brake cylinder pressure escapes through the exhaust port to the atmosphere, through the auxiliary reservoir and bleeder cock to the atmosphere, and when the brake piston returns to and stands on the leakage groove, a part of the remaining brake cylinder pressure escapes through the groove to the atmosphere.

(142) G. E. C., Moncton, N. B., Canada, writes:

In using retaining valves on grades, should they be turned up before the summit of the up-grade is turned or not? A.—No. 2. If they were turned up before the summit was reached, and the leakage groove in any of the brake cylinders should be stopped up, would not any leak that would allow air pressure to reach the brake cylinder, set that brake and cause it to drag? A.—Yes. 3. Would the triple valve have to move to service position for such a brake to set? A.—No. Leakage of train pipe pressure past the quick-action parts or auxiliary reservoir pressure past the slide valve into the brake cylinder, would cause the brake piston to bring the brake shoes against the wheels and the brake to drag. 4. If the leakage into the brake cylinder was greater than the escape port *D* on the retainer, would not the brake have more than 15 pounds in its brake cylinder? A.—Yes.

(143) G. McL., Columbus, Ohio, writes:

A New York pump governor shuts down the pump (No. 2 duplex) but it is very slow in starting the pump again. Sometimes ten or fifteen pounds has to be drawn off to make the pump go to work. Also the pump runs very slow and is getting worse all the time. It is not more than six months old and the governor less than that. In your opinion what is the matter? A.—The trouble lies in your governor. First examine the small relief port which leads from the chamber above the piston to the atmosphere, and be sure it is clear. If it is not, the air pressure must leak past the piston packing ring to the lower chamber, thence to the atmosphere through the waste-away port before the governor can operate. Next examine the steam valve. Sometimes, in limestone water districts, such as yours, lime scale forms on the steam valve and gives trouble in both opening and closing. Scale may be preventing your steam valve from opening, and you will probably find your trouble there.

(144) B. R. M., Toledo, Ohio, writes:

Some engines I have noticed have no angle cock on the rear end of tank. When the engine is coupled on to a train, the air is all drained out of train line first. They say the reason the angle cock was done away with was because it got closed. Now, if the tender angle cock will close, why won't the angle cock on head end first car close too? If you do away with the tender angle cock, why shouldn't you also do away with the angle cock on the head end first car? And, for that matter, why don't this road do away with all angle cocks? A.—Possibly the angle cock on the tender was the only one to give trouble, and attention has therefore been attracted to this one only. To a person who maliciously seeks to close an angle cock, that one on the head end of the first car is equally accessible as the one on the tender. The modern-built vestibule car might not be so handy. Nevertheless, if there is such a person with malicious purpose, he will find an angle cock somewhere; if not on the engine, he will back in the train. If he is bent on mischief, and can't do it with angle cocks, he will find some other way. Sometimes swinging safety chains, loose train pipes and interference from uncoupling devices will close an angle cock. Whatever is the cause of the trouble it should be rooted out.

(145) G. E. C., Moncton, N. B., Canada, writes:

A train was made up as follows: Engine equipped with a 9½-inch Westinghouse pump, a mail, two baggage and a second-class car equipped with Westinghouse quick-action triples, a dining car and two sleeping cars equipped with New York quick-action triples. After running 150 miles, and the brakes working perfectly, and when about two or three miles from a station where the train had stopped, the brake applied on the second-class car. The engineer was signalled to release brakes. He did so, and the brake on this car released; but in a minute or two it applied on the first-class car. The engineer was again signalled to release brakes. He did so, and the brake released again. In a minute or two it applied on the dining car. The engineer released it, then it applied on the second-class car again. This time the engineer could not release it, and the train had to be stopped and the brake released by opening the release cock on its auxiliary reservoir. There were no leaks to be seen or heard about the cars or engine. The engineer said the gage showed 70 and 90 pounds when he was signalled to release brakes. The brakes afterwards worked perfectly to the end of the run, about 40 miles. You will see that the brake applied only on three cars out of eight, these cars being in the center of the train, and only on one car at a time. What was the cause of the trouble? A.—The brake valve evidently failed to feed the train pipe properly in running position, probably due to the presence of dirt or gum on the excess pressure valve, or feed valve if the Westinghouse brake valve was used. If the New York brake valve was used, the excess pressure valve was probably gummed, and possibly the trouble was further aggravated by a leak of main reservoir pressure into the governor cavity of the brake valve, thus holding the pump shut down. The three brakes that stuck probably did so because they were more sensitive than the others. This they are likely to do, either singly or in group.

Of Personal Interest.

Mr. Henry Ashton has been appointed master mechanic of the Intercolonial at Moncton, N. B.

Mr. J. P. Baker, Jr., has been appointed superintendent of the Frederick division of the Erie at York, Pa.

Mr. D. E. Cain has been appointed assistant to the general manager of the Atchison, Topeka & Santa Fé; office at Topeka, Kan.

Mr. Martin C. Smith has been promoted from division foreman on the Southern Pacific at Roseburg to general foreman at Portland, Ore.

Mr. L. L. Smith has been appointed division master mechanic of the Fort Dodge division of the Chicago Great Western at Fort Dodge, Ia.

Mr. George F. Cotter has been appointed trainmaster of the Rio Grande Western at Salt Lake City, Utah, vice Mr. A. T. Miller, resigned.

Mr. H. A. Ferguson has been appointed general foreman of the Oelwein, Ia., shops of the Chicago Great Western, vice Mr. L. L. Smith, promoted.

Mr. C. J. McMaster, master mechanic of the Rutland at Malone, N. Y., has been appointed assistant superintendent of rolling stock at Rutland, Vt.

Mr. O. G. Cheatham has been appointed master mechanic of the Fifth Division of the Seaboard Air Line at Fernandina, Fla., vice E. Burton, deceased.

Mr. Victor Wierman has been appointed superintendent of the Amboy division of the Erie at Camden, N. J., vice Mr. F. P. Abercrombie, transferred.

Mr. L. M. Hardy has been appointed general superintendent of the Missouri Pacific, succeeding Mr. H. G. Clark, resigned; office at St. Louis, Mo.

Mr. E. M. Collins has been appointed general superintendent of the Missouri, Kansas & Texas, vice Mr. E. M. Sweeney, resigned; headquarters at St. Louis, Mo.

Mr. George W. Kenney, superintendent of motive power of the Rutland, has been appointed superintendent of motive power and rolling stock, with office at Rutland, Vt.

Mr. C. F. Thomas has been appointed master mechanic of the Savannah division of the Southern, vice Mr. N. E. Sprowl, transferred; headquarters at Columbia, S. C.

Mr. E. H. Wade has been appointed assistant master mechanic of the Wisconsin and Northern Wisconsin divisions of the Chicago & North Western at Fond du Lac, Wis., vice Mr. A. B. Quimby, transferred.

Mr. R. P. Dalton, superintendent of the Valley division of the St. Louis, Iron Mountain & Southern, has been transferred to the Central division, vice Mr. W. T. Tyler, transferred; office at Van Buren, Ark.

Mr. J. H. Rathbone has been appointed assistant division master mechanic of the Denver & Rio Grande, vice Mr. John Kelker, resigned; headquarters at Pueblo, Colo.

Mr. J. F. Deems, superintendent of the Chicago, Burlington & Quincy, has been appointed superintendent of the Schenectady Works of the American Locomotive Company.

Mr. J. M. Walsh, trainmaster of the Memphis division of the Choctaw, Oklahoma & Gulf, has been appointed general manager of the Arkansas Southern at Ruston, La.

Mr. W. R. Phillips, foreman of car repairs of the Southern at Louisville, Ky., has been appointed master car builder of the Mobile, Jackson & Kansas City at Mobile, Ala.

Mr. J. W. Shilling, roundhouse foreman at Jonesboro, Ark., for the St. Louis Southwestern, has been appointed general foreman of the Denver & Rio Grande at Pueblo, Colo.

Mr. V. H. Stevens has been appointed trainmaster of the Beaumont division of the Gulf, Colorado & Santa Fé at Beaumont, Texas, succeeding Mr. R. L. Cairncross, resigned.

Mr. D. Hardy, superintendent of the Missouri Pacific at Sedalia, Mo., has been promoted to general superintendent, with office at St. Louis, Mo., vice Mr. H. G. Clark, resigned.

Mr. James McDonough has been appointed acting general master mechanic of the Gulf, Colorado & Santa Fé at Cleburne, Texas, succeeding Mr. Thomas Paxton, resigned.

Mr. H. G. Clark, general superintendent of the Missouri Pacific, has been appointed general manager of the Choctaw, Oklahoma & Gulf at Little Rock, Ark., vice Mr. Henry Wood.

Mr. N. J. Finney has been appointed superintendent of the Sedalia, Kansas City and Hannibal divisions of the Missouri, Kansas & Texas at Sedalia, Mo., vice Mr. J. A. Davis, transferred.

Mr. A. B. Quimby has been appointed master mechanic of the Northern Iowa division of the Chicago & North Western, succeeding Mr. E. H. Wade, transferred; headquarters at Eagle Grove, Ia.

Mr. W. D. Stearns, trainmaster of the Cincinnati Northern, has accepted a similar position on the Detroit, Toledo & Milwaukee division of the Lake Shore & Michigan Southern at Toledo, O.

Mr. E. J. Lambert has been appointed superintendent of the St. Louis and Hannibal divisions of the Missouri, Kansas & Texas at Franklin Junction, Mo., succeeding Mr. N. J. Finney, transferred.

Mr. J. A. Davis has been appointed superintendent of the Parsons, Cherokee and Neosho divisions of the Missouri, Kansas & Texas, with office at Parsons, Kan., succeeding Mr. L. W. Welch.

Mr. John Irwin has been appointed assistant superintendent of the Second and Third divisions of the Denver & Rio Grande at Salida, Colo., succeeding Mr. W. D. Lee, assigned to other duties.

Mr. A. H. Smith, general superintendent of the Lake Shore & Michigan Southern, has been appointed general superintendent of the New York Central at New York, succeeding Mr. P. S. Blodgett.

Mr. Chas. M. Bloxham has been appointed master car builder of the Union Tank Line Company, vice Mr. C. A. Smith, appointed consulting engineer; headquarters, 26 Broadway, New York.

Mr. A. H. Thomas, general foreman of the locomotive department of the Chicago, Milwaukee & St. Paul, has been appointed mechanical engineer at Milwaukee, Wis., succeeding Mr. R. R. Bradley, resigned.

Mr. Robert Miller, who recently made a very successful trip through South Africa in the interest of the Magnolia Metal Company, has sailed for Europe for the purpose of pushing their business there.

Mr. P. S. Blodgett, general superintendent of the New York Central & Hudson River, has been appointed general manager of the Lake Shore & Michigan Southern at Cleveland, O., vice Mr. W. C. Brown.

Mr. F. P. Abercrombie, superintendent of the Amboy division of the Pennsylvania, has been transferred to the New York division, with headquarters at Jersey City, N. J., succeeding Mr. R. M. Patterson, promoted.

Mr. W. T. Tyler, superintendent of the Central division of the St. Louis, Iron Mountain & Southern, has been transferred to the Missouri division at De Soto, Mo., succeeding Mr. J. R. Wentworth, resigned.

Mr. F. K. Huger, superintendent of the second division of the Seaboard Air Line, has been appointed superintendent of the Charleston division of the Southern at Charleston, S. C., vice Mr. A. Gordon Jones, transferred.

Mr. Joseph Harris has been appointed assistant to Mr. F. D. Casanave, general superintendent of motive power of the Baltimore & Ohio at Baltimore, O. Mr. Harris was formerly in the Pennsylvania shops at Fort Wayne, Ind.

Mr. A. G. Wells, general superintendent of the Santa Fé Pacific, Southern

California and San Francisco & San Joaquin Valley, has been made general manager of the above roads, vice W. G. Nevin, deceased; office at Los Angeles, Cal.

Mr. C. A. Swan, Jr., who for the past four years has been the mechanical engineer for the Hayden & Derby Manufacturing Company, has resigned in order to accept a similar position with the Universal Car Bearing Company, of Chicago, Ill.

Mr. Hugo Schaeffer has been appointed division master mechanic of the Arizona division of the Southern California at Needles, Cal. His jurisdiction extends from Seligman, including that point to Bakersfield. The office of division foreman at Needles is abolished.

Mr. M. Sweeney has been appointed general superintendent of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn. He was presented with a handsome diamond ring by the officials and employés of the Missouri, Kansas & Texas before leaving that road who recently resigned to accept road foreman of engines on the St. Louis, Iron Mountain & Southern.

Mr. W. C. Brown, vice-president and general manager of the Lake Shore & Michigan Southern, has been elected third vice-president of the New York Central & Hudson River, with office in New York. He will continue as vice-president of the Lake Shore & Michigan Southern and Lake Erie & Western, but relinquishes the duties of general manager.

Mr. Thomas Paxton, master mechanic of the Gulf, Colorado & Santa Fé at Cleburne, Texas, has been appointed superintendent of motive power of the Colorado & Southern at Denver, Colo., vice Mr. A. L. Humphrey, resigned. Mr. Paxton has been with the Santa Fé since April, 1884, and been master mechanic of the Gulf, Colorado & Santa Fé since March, 1901.

Mr. J. J. Reed has been appointed assistant superintendent of motive power on the Rutland at Rutland, Vt. Mr. Reed is a protege of Mr. D. L. Barnes, and was for a time with the Maine Central as general foreman at Waterville, Me.; the Pittsburgh Locomotive Works, in drafting department, and then to the Rhode Island Locomotive Works. He went from there to the Delaware, Lackawanna & Western, and is a thorough draftsman and mechanic.

Mr. Spencer Otis, who has been acting as Chicago representative of the Rhode Island Locomotive Works prior to the consolidation of the eight locomotive works into the American Locomotive Company, has been appointed the Western representative of the American Locomotive Company, with office in the Fisher Building, Chicago.

Mr. Wilson Worsdell, locomotive superintendent of the Great Eastern Railway of England, who was taken ill with congestion of the lungs during a visit he made to the United States last fall, has not yet quite recovered. He persists in attending to his duties, and his friends are afraid that the lung trouble may bring about a serious ending.

Charles Cartwright, traveling engineer on Minnesota & Iowa and Nebraska divisions of the Chicago, St. Paul, Minneapolis & Omaha Railway, died February 17th at his home in St. Paul, Minn., of pneumonia. He succeeded W. L. Kellogg,

Mr. W. R. Johnson, formerly master mechanic of the Pennsylvania division of the Delaware & Hudson Railroad and late instructor of the Railway Instruction Department of the International Correspondence Schools at Scranton, Pa., has resigned the latter to accept that of general manager of the Carbondale Metal Working Company, a large foundry and machine works lately established there. Mr. Johnson's vast experience in machine shop practice has him well equipped for his new duties.

The following changes have been made in the New York Central & Hudson River Railroad: Mr. G. H. Haselton, division superintendent motive power at West Albany, succeeding Angus Brown, deceased; Mr. John Howard, division superintendent motive power at Depew, succeeding Mr. G. H. Haselton, promoted (was at Corning, N. Y.); Mr. E. A. Walton, master mechanic River division, division superintendent motive power at Corning, succeeding Mr. John Howard, promoted (was at New Durham, N. J.).

Mr. F. N. Risteen, assistant superintendent of motive power of the Chicago, Great Western at Oelwein, Ia., has been appointed mechanical superintendent of the Eastern division of the Atchison, Topeka & Santa Fe at Topeka, Kan., and Mr. C. M. Taylor, master mechanic at Albuquerque, has been appointed mechanical superintendent of the Western division at La Junta, Colo. These two gentlemen assume the duties performed by Mr. James Collinson, general master mechanic, recently resigned.

Mr. W. J. Wilcox, who has had charge of the Santa Fé shops at Los Angeles, Cal., for the last two years, has accepted the position of division master mechanic on the Mexican Central at the City of Mexico, Mex. His past experience is mechanical engineer Cornell University, Ithaca, N. Y.; general foreman Pittsburgh & Western, Allegheny City, Pa.; chief draftsman Southern Railway, Charleston, S. C.; master mechanic South Carolina & Georgia, Blacksbury, S. C., and division master mechanic Santa Fé, Winslow, Ariz

English Versus American Locomotives

Perhaps one of the most interesting and valuable comparisons between the merits of the English and American built locomotives comes from the Sanyo Railroad Company, of Japan, where the two types are daily in the same service, side by side. For a number of years the British-built locomotive was used exclusively on this road. Six years ago, however, the American engine was introduced in competition, and the result of the experience derived is forcibly reflected in the present equipment, which consists of thirty-three American locomotives as against twenty-four British engines. Further, the Sanyo Company has placed a recent order with an American firm for eighteen additional locomotives. According to the claims of this railroad, the American engine is ahead in design, and the English make excels in workmanship and finish. The boilers of the latter are less liable to leak.

The Perfect Compensating Throttle Valve, which was designed by Mr. J. S. Chambers and illustrated by us about eighteen months ago, has been put upon the market and is becoming very popular as a remedy for leaky throttle valves—a nuisance from which nearly all railroad companies have suffered more or less. The headquarters of the Compensating Valve Company are 141 Broadway, New York

To Adopt the Merit System.

A circular has been issued from the general office of the Houston & Texas Central Railroad announcing that the merit system will go into effect on that road, and that all the employés of the road from the highest to the lowest will be given merit and demerit marks, and their records will determine what their future will be.

This order affects every employé in the service of the road, in stations, offices and train crews. This is one of the reforms that are all right when fairly carried out, but it can be made a medium of refined tyranny which the old rough and ready system of discipline never approached. Its working sometimes suggests Madame Roland's words, "Oh, Liberty, what crimes have been committed in thy name!"

The Edwards Electric Headlight.

For quite a number of years the Edwards Railroad Electric Light Company have been working on the development of an electric headlight for locomotives. Perfection was aimed at, so that there would be no more difficulty in using an electric headlight than there is with one of the ordinary type. The experiments proved protracted and expensive. When what the inventor thought would be a perfect apparatus was put upon practical tests it generally suggested radical changes, which were effected and again tried. Under this tentative system the headlight was developed, until now the makers consider that the end of improvement has been reached.

As perfected, the apparatus consists of (1) the motor, a simple acting steam turbine; (2) the dynamo coaxially connected with the preceding and designed to yield to the arc a current of from 30 to 33 amperes and from 30 to 35 volts; (3) the lamp, including the arc, the reflectors and the case, and (4) the bed plate on which the whole apparatus is mounted.

The first of these perfected headlights was placed upon an engine belonging to the Big Four system, and illuminated the track between Cincinnati and Indianapolis for 153 nights without a single failure. The reliability thus demonstrated was what the inventor worked to secure, and the indications are that he has succeeded. About three months ago two of these headlights were placed on express engines belonging to the Chicago, Milwaukee & St. Paul, and a public exhibit of one of them was made on February 12th, when the photograph was taken from which the annexed engraving was made. Several of the leading officials of the road were present at the display and a number of invited spectators. The tests were eminently satisfactory. The picture shows how minutely the track and everything near the right of way can be seen for a distance nearly a mile in extent. A peculiar feature about this headlight is that it has the auxiliary plane deflector, which projects the light upwards at an angle of 45 degrees, making a column of light signal in the air which can be seen at a long distance and will prove a safety device of very great value.

The writer enjoyed the pleasure a few weeks ago of going through the factory, in Cincinnati, where these headlights are made, and the design of all the parts and the method of manufacture were made very plain. They make every part of the apparatus and have special machinery for doing the work that insures accurate reduplication and low cost of manufacture. The two most important members of the headlight are the driving engine which provides the power and the dynamo which generates the light. These have received particular attention from the designer, and both combine simplicity with the elements of durability and seem to be free from lines of weakness which bring many small steam motors and small electric generators to disorder.

The engine is a steam turbine with a propeller wheel of rolled steel, and deformed buckets interlocked with the steel plates, making a very compact and simple type of engine. It uses the steam with fair economy and will work a long time before the deterioration due to wear will render it wasteful of steam.

The dynamo is of peculiar construction. The field is differentially wound, and it is claimed that the electric circuits are so arranged that a burned-out armature is impossible. Should a short circuit occur upon any point of the circuit, the current is killed, and no matter how long the engine may run or the armature rotate there will be no production of current whatever until the short circuit is removed. As soon as this is done the dynamo performs its proper functions and operates as usual. The current densities throughout the whole machine are very low, so that a minimum heat effect is produced, regardless of extremes of temperature or other conditions which might affect the resistance of the machine. The electrical balance is so perfectly adjusted that absolutely no spark or flash is ever perceived at the brushes. Low resistance carbon brushes are used, and many months of constant wear show very little deterioration of these brushes. This dynamo is wholly constructed in its essential magnetic parts of soft rolled steel, die formed, and very carefully made. Everything that developed knowledge, financial enterprise and engineering care and skill could achieve has been employed to make this headlight a success. These form the basis on which the company request the patronage of railroad companies.

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EDWARDS ELECTRIC HEADLIGHT.

Organization of the recently incorporated American Palace Car Company has been completed by the election of the following officers: J. H. Hoadley, president; W. J. Arkell, vice-president, and William J. Hoagland, secretary and treasurer. James M. Brady has resigned as director of the Pressed Steel Car Company and has been elected a director of the American Palace Car Company. It is stated that the company has placed orders for 100 of its palace sleeping cars, to be operated principally on European roads

The Central Railroad of New Jersey has placed orders with the American Car & Foundry Company for 1,000 box cars, twenty passenger coaches, 750 hopper cars and 500 gondolas. The Harlan & Hollingsworth Company is building thirty coaches for the Central and sixty locomotives are being built by the American Locomotive Company.

The Southern Pacific Company, which have several oil-burning locomotives in use with the Vanderbilt boiler, have placed an order for forty engines with the same kind of boiler.

Railroad Reminiscences.

BY ANDREW CARNEGIE.

The following address was delivered by Mr. Carnegie at the twenty-sixth anniversary of the Railroad Branch of the Young Men's Christian Association, Madison avenue, New York.

CORNELIUS VANDERBILT.

It gives me great pleasure to meet you to-night, especially since the name of one whose memory all men honor is the charm which draws me here. It was my good fortune to serve as vice-president under Mr. Cornelius Vanderbilt when he was president of the Botanical Society, and during his indisposition I sat in his place. I got to know him well, and to admire him. I doubt if a man ever lived who attracted other men in greater degree, a man who never made an enemy. None know better than yourselves his conscientious devotion to duty. Among all the institutions which shared his attention none stood closer to his heart than yours. He left us all the most precious legacy that a man can leave, the record of a life spent in the service of his fellows.

IS AN OLD RAILROADER.

Mr. Cox reminded me in his invitation that I had a right to claim kinship with you as one of the brotherhood of railroad men. It is a matter of great satisfaction and some pride to me that I began in the railroad service as telegraph operator and rose so high before I ceased that I was superintendent of the Pittsburgh division of the Pennsylvania Railroad. (Laughter.) Perhaps it would be interesting to contrast in a few particulars the condition of affairs in the railroad world then and now. We are always urged to look well ahead in railroading. It is one of the chief rules, but upon an anniversary occasion like this, it is well to cast a look back and see the progress that has been made.

WHAT WE CALLED EACH OTHER.

In the secretary's address you heard the name Pitcairn and that the Pennsylvania Railroad is to spend $35,000 on a Young Men's Christian Association building there. There he sits in the front row. Why, he is not Pitcairn; he is "Bob." And here is your great officer of the Lake Shore, the New York Central and all the rest, that you call Mr. Layng. Nonsense! Why, I know him; he's "Jim." (Laughter.) We were all boys together in dear old smoky Pittsburgh. Then I am introduced here to-night as *Mr.* Carnegie! Bless your hearts, they call me "Andy," and there is no name that I am called by that is half so sweet. Whenever I go to Pittsburgh and some old friend or old engineer comes up and says, "How are you, Andy?" there's my pocketbook. (Laughter and applause.) Why, some of those old fellows in Pittsburgh would pity you if you had to refer to me as Mr. Carnegie.

PIONEER DAYS OF THE PENNSYLVANIA.

Well, now, just think of it, I'm in the prime of youth (laughter), and yet when I entered the service of the Pennsylvania Railroad it was not completed to Pittsburgh. I have seen the first telegraph line stretched to Pittsburgh, and wondered how the messages got through the little insulators on the poles. I have seen the first locomotive brought by canal to Pittsburgh. I have delivered messages (and so has "Bob," and I guess "Jim," too) to the first white man born west of the Ohio River—General William Robinson, of Allegheny—and I am young yet and going to see a great deal more, I hope, before I die.

The Pennsylvania Railroad was not completed then. By means of some miles of staging between two points, and a climb over the mountains by means of ten inclined planes, the passenger was enabled to reach Philadelphia by rail. The rails on the mountain were iron, 14-foot lengths, imported from England, lying on huge

To my friend Angus Sinclair
with [illegible] Andrew Carnegie

hewn blocks of stone, although the line passed through woods and ties would have cost little. The company had no telegraph line and was dependent upon the use of the Western Union wire. Mr. Scott, the superintendent, the celebrated Thomas A. Scott who was afterward president, often came to the telegraph office in Pittsburgh to talk to his superior in Altoona, the general superintendent. I was then a young operator and made his acquaintance by doing this telegraphing for him.

OLD-TIME SALARIES.

I was receiving the enormous salary of $25 per month then, and he offered me $35 to become his secretary and telegrapher, which meant fortune. Let me congratulate you upon the great advance in your own wages and salaries since then. Mr. Scott received $125 a month—$1,500 a year, and my wonder was what a man could do with that amount of money. (Laughter.) I hadn't thought then of one use—he might succeed by giving part of it away. (Laughter.)

ADVANTAGES OF WEALTH.

What are the advantages a man receives from wealth is often discussed. You hear a great deal about surpluses. Now let me tell you something right from my heart. I want to say, between ourselves, and not to go any farther, there is nothing in money beyond a competence, nothing whatever. I tell you care and trouble come of more. The advantages of wealth are not to the individual owner. The advantages of wealth are what it enables its possessor to do for others. (Applause.)

I served for some time before I received an advance in salary of $10 per month. You hear a great deal about the Roentgen or X-rays these days, but the finest *raise* that ever I heard of up to that time or since was that X-raise of $10. (Laughter and applause.) That gave me an enormous revenue compared with the $1.20 a week at which I started in the cotton factory.

TENDENCY OF WAGES TO RISE.

It is one of the most cheering facts of our generation that under present conditions the wages of labor tend to rise, and the price of the necessaries of life tend to fall. There never was a nation so splendidly situated as ours is at this moment in regard to labor. Every sober, capable and willing man finds employment at wages which with thrift and a good wife to manage will enable him to go far toward laying up a competence for old age. Those of you so fortunate as to be married know how much depends upon a wife who can manage your household affairs (and you also), and those of you who are not yet married will find that out. There is nothing that success and happiness of a workingman so much depend upon, next to his own good conduct, as a good managing wife. (Applause.) What all of you should strive for is a competence, without which Junius has wisely said no man could be happy. No man *should* be happy without it, if it be within reach, and I urge all of you to save part of your earnings these prosperous days and put it in the savings bank at interest, or, better still, buy a home with it.

PREDICTED THAT THE PENNSYLVANIA RAILROAD WOULD HAUL 100 CARS A DAY.

But to revert to railroading. President Thomson one day amazed the community of Pittsburgh by stating that on some future day the Pennsylvania Railroad would transport 100 cars a day. (Laughter.) Cars then carried 8 tons each. We had small locomotives and the roadbed was something to frighten one. It was laid with light rails and cast-iron joints were used. I have known forty-seven broken joints found one morning in winter on my division, and it was over such a

line that we ran our trains. Can you wonder that breakdowns were frequent? We had no cabooses on freight trains. Trainmen had to be out in all weathers. It was single track, and not having a telegraph line, in case of delays trains ran curves; that is, a flagman went ahead and the train followed and met when they could, and sometimes met with considerable force on the sharp curves. There is nothing apparently takes so long to learn by the average railroad man as this proposition, that two trains cannot pass each other successfully on a single track. (Laughter.) We never quite learned that even on the Pittsburgh division anyway. Maybe Pitcairn is somewhat more successful, but then he has double-track. (Laughter.) I do not think that problem has been solved anywhere yet. I was talking with Mr. Marconi to-day at lunch. He did me the honor to come to see me. Perhaps, when he gets through with wireless telegraphing, he will take up and solve this problem of how to pass two railroad trains on one track.

MAKE OTHERS DO THE WORK.

Being a telegrapher I took charge of our own railroad telegraph wire when it was constructed, and I believe that I placed the first young woman telegraph student at work on a railroad; so I see it stated. In those days the superintendent had to do everything; there was no division of responsibilities. It was supposed that no subordinate could be trusted to run trains by telegraph or attend to a wreck, and Mr. Scott and I, his successor, were two of the most foolish men I have ever known in this respect. We went out to every wreck, worked all night; often I was not at home for a week at a time, scarcely ever sleeping, except a few snatches lying down in a freight car. That did me good, for now I can lie down anywhere and in twenty minutes get a good nap. I tell you there's nothing so good for the health. (Laughter.) I now look back and see what fool superintendents we were; but I had a great example in Mr. Scott. It took me some time to learn, but I did learn, that the supremely great managers, such as you have these days, never do any work themselves worth speaking about; their point is to make others work while they think. I applied this lesson in after life, so that business with me has never been a care. My young partners did the work and I did the laughing, and I commend to your superintendents, and to yourselves, the thought that there is very little success where there is little laughter. The workman who rejoices in his work and laughs away its discomforts is the man sure to rise, for it is what we do easily, and what we like to do, that we do well. When you see a president or superintendent or a treasurer loaded down with his duties, oppressed with care, with a countenance as serious as a judge uttering a death sentence, be sure that he has more responsibility than he is fit for and should get relief. Remember that if anything is a labor to you and your heart is not in it, I do not think there is much promotion for you. If Mr. Pitcairn, Mr. Rossiter or any of your officials are looking for a young man to promote to higher duty they will never pick out the man who seems to be weighted enough with what he has now, but they will take the young man who laughs and says, "Throw it on; I want more load." He goes right up. He is the kind of a man that Layng says will become a general superintendent. The load is nothing to him; he's glad it's there.

LAUGH CARE AWAY.

Laugh off trouble. I think that is one of the best pieces of advice I can give you young men. Tell jokes, good funny stories, nice stories, and laugh it off. Don't be too solemn. The Christian religion used to be a fearfully solemn thing, but it isn't any more. You can have your happiness, your pleasures, your jokes and your fun and still pass any examination that you may have to undergo for admission to a church, I assure you. I think Dr. Greer will agree with me. (Laughter.) (Dr. Greer: "That's good doctrine.")

SPEED OF TRAINS.

Now compare the speed of trains. On the great Pennsylvania Railroad we thought that we had reached perfection when a passenger train was put on which ran between Pittsburgh and Philadelphia in 13 hours, about 27 miles an hour. It was christened the "Lightning Express." That was not because we thought the lightning was so slow, but because we thought the train was so terrifically fast. To-day you run at just double this speed with the Empire State Express, which holds the world's record. But do not let us make the mistake again of thinking that we have reached perfection. Your sons who are to succeed you on the New York Central will run trains at 100 miles an hour, double your present speed, just as you are running trains at double the speed of thirty years ago. The line will be straight. In the language of Scripture, "the crooked places," that is the curves, "shall be made straight."

In the improvements made today on the various lines I don't think many managers look far enough ahead. They are spending on some parts perhaps half a million dollars where they ought to spend double, and easing the curves which they should abolish, and some future president is to say that they wasted a good deal of money. Nothing but a straight line will be up to date in 1950, or before that. The New York Central has not as much to do as the Pennsylvania Railroad in this direction, but she has enough. (Laughter.)

PROVIDING FOR THE FUTURE.

But, gentlemen, there is another department in which progress has been as great, and even of greater importance than the physical and mechanical of which we have been speaking. It is in the care of railroad employés, their position, their advantages, their earnings and in the pension system which the leading railroads of this country feel themselves obligated to establish, that you who labor year after year at stated salaries and have no prospect of making great gains should at least have this consolation in view, that in your old age you will be able to live in comfortable independence, not as a matter of charity, but by virtue of your own exertions, and what you are entitled to as a bonus for faithful service rendered. I know of nothing which lifts and improves the service of a great line and adds so much to its safety as a staff which can rest in the knowledge that after they have grown old in the service their old age is made comfortable through the system of pensions. (Applause.) Personally I do not believe that any road will be considered to have done its duty which does not promptly establish a pension system somewhat on the lines of the systems existing on the Baltimore & Ohio, the Pennsylvania, the Santa Fé and other companies. The line that does the best for its men does the best for its shareholders. (Applause.) Great as has been the progress made upon the part of proprietors in recognizing their duties to their employés beyond the mere paying of their wages, a great void yet remains for them to fill. None of them do enough, and if they would only bear in mind that, so far from labor and capital being antagonistic, they are allies, and that you cannot benefit the one permanently without benefiting the other, great good would result to both. It is a great delusion to say that labor and capital are foes; they must be allies, or neither succeeds. I have before used the simile of likening Capital, Business Ability and Labor to the legs of a three-legged stool; the stool will not stand up without the support of all these three legs, and to dispute as to which of the three is most important is useless. It can never be determined, and if determined it would be of little consequence, since the great fact remains that they are all absolutely necessary for such success as we see on the New York Central Railroad and other great transportation lines of our country.

I congratulate you also upon this fact, that wherever improving agencies have been established the men have endeavored to show their appreciation by using them to the fullest extent. Railway companies can make no better use of money than in establishing additional institutions of this kind and in enlarging those which already exist and are crowded. It will be upon that line you, the working man, will feel most at home, and in which you will take the greatest pride, and for which you will be most willing to incur the exhausting labor and danger incident to your calling, thus giving another proof that your interest and the interest of those whose capital is invested are not antagonistic, but mutual.

BENEFIT OF MEETING ROOMS.

In the buildings now being provided at

transfer stations, in the reading rooms and libraries, and in some cases, especially on the Santa Fé route, I learn billiard tables and other means of harmless and needful entertainment are provided; last, but not least, in such buildings and societies as this of yours which draw men together for their good, in all these improvements, and in many other ways we have evidence that employers are recognizing their duties to the employed more clearly than in the past.

Gentlemen, I congratulate you of the railroad world on occupying the proud position, as I believe, of the most temperate body of employés in the world. I do not know of any department of labor which shows such sobriety as the railway service of the United States. You are an example to the working man in other branches of the outspreading tree of labor, and your influence cannot fail to prove of incalculable benefit. A drinking man has no place in the railway system. Indeed, he should have no place anywhere.

There is nothing he can do that is so wise as to resolve not to use whisky, alcohol, as a beverage. No man needs it, unless his physician advises it, until he is much older than Pitcairn and "Jim" and myself are. (Laughter.) After sixty years, if your physician says to you, "Take a little alcohol at meals" (but never between meals), you have my august permission (laughter), but until then there is nothing so fatal to a man's happiness in this world and to his success as the habit of drinking alcoholic liquors.

Now, there is nothing wiser a man can do than to better his future, or to better his present, which is much more important than the future, than to attend to the things of to-day and not worry about the things of to-morrow.

Also permit me to congratulate you upon the satisfactory relations which exist, upon the whole, between the railroads and their men, which is always sure to be created and to exist where the officers are intelligent and sympathetic, and feel themselves part of the one organization which manages the line, comprising all employés from the track laborer to the locomotive engineer and up through all grades to the president himself, every one a New York Central, or a Pennsylvania Railroad, or a Chicago, Baltimore & Ohio, or a Delaware, Lackawanna & Western man.

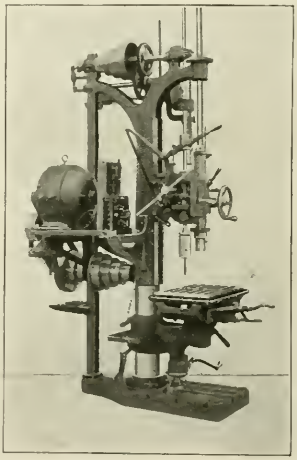
PLEASANT RELATIONS BETWEEN EMPLOYER AND EMPLOYE.

There is no room for antagonism upon a railroad between employer and employé, for your president and superintendent do not own the property any more than you do; therefore you are, as just said, members of the same corps; you are all equally the servants of the company. The official, therefore, recognizes in you employés like himself to whom he must naturally feel the glow of comradeship, while you cannot but regard the officials as your fellow members and feel that in all matters of compensation or discipline, what your fellow members in office prescribe has not for its end their own self-aggrandizement, but the successful operation of the line of which you are the staff.

There is another feature of cheering import in your positions. The road to promotion is clear and direct. You can all certify to that; for, I doubt not, many of those now in authority over you began as you did in subordinate positions and have won their way by merit, not by favor. Very few of you here I take it occupy the positions you did at the start.

FROM OFFICE BOY TO GENERAL SUPERINTENDENT.

Mr. Layng was just now telling me about a boy who entered his office at $3 a week and who is now general superintendent of the Pennsylvania Railroad. When Mr. Layng took on that boy at $3 a week, what do you suppose he said to



GOULD & EBERHARDT ELECTRICALLY DRIVEN DRILL.

him? He said, "Do you want to be general superintendent of this railroad?" and that boy answered, "Yes, sir, I do." That boy (his name is C. E. Schwayler) is now general superintendent of the road. I want you to notice how he spells his name —Schwayler. He will probably go higher soon and be general manager of the Pennsylvania Railroad. Why, here is "Bob" here, and Layng himself. You can't fool me about those boys; you know I know them. (Laughter.) There never was any mischief that I was in that they were not in with me; but I wouldn't give them away for the world. "Bob" came over from Scotland when a boy—well, I won't tell you all the things I know about "Bob," but he was a nice fellow and he went on the Pennsylvania road and he learned telegraphy, and here he is now on the official corps of the Pennsylvania system at Pittsburgh, not under anybody but the president, and I have heard from several that the president is undoubtedly more under "Bob" than "Bob" is under him. (Laughter.) By the way, gentlemen, that's a thing you must always do—never fail to boss your boss. (Laughter.) I guess your chief official had a lot of the same kind of trouble with Layng. If you do not know more about your own department than the official over you does you will never get to the top. (Laughter.)

Every man in the railway industrial army, as Napoleon said of his army, carries a marshal's baton in his knapsack. I hope more than one of you feel it rattling about somewhere seeking entrance. Don't forget to give it full sway. Fellow railroaders, there rest upon you grave responsibilities; you have in your keeping the lives of the public—I need not say the traveling public, for with us all travel. Strict sobriety, unceasing vigilance, staunch courage, faithfulness to duty are demanded from you, and that these are characteristic of the force is testified at recurring intervals and by the position you have reached and occupy in the estimation of your grateful fellow citizens. I am delighted to be with you to-night and beg to thank Mr. Cox for so kindly inviting me to your anniversary. (Applause.)

Electrically-Driven Drill Press.

The accompanying cut shows the latest improvements in the 25-inch upright power feed drill press made by Gould & Eberhardt, Newark, N. J., and was made from one of a lot of machines recently shipped to the new United States Government Printing Office at Manila, P. I. The table and table arm are now raised by bevel gear and screw. As the gearing for raising and lowering the table is placed about central between the center of the column and the drill spindle, it equalizes all strains and weights brought to bear on the table.

Eberhardt's patent automatic tapping attachment is shown on left of drill spindle proper, and is used for tapping holes after they have been drilled, the work being rapidly moved across and centered under the tap by means of the oblong, compound traverse table. It can be used for tapping holes, either bottoming or through, large or small up to its full capacity. After it is set and started it will go to the proper depth, reverse and run back, and is ready again for the next hole. It is provided with a safety friction device which relieves the strain and prevents the tap from breaking should it strike the bottom of the hole or from any cause become fast in the work. The method of arranging direct-connected electric motor is also shown.

Table and base plate are large and sufficiently braced to maintain perfect rigidity of the machine, the column being practically one casting.

An index placed over each step of the *lower* cone, tells the operator the correct belt speed at which to run the various-sized drills. An index placed under each

step of the *upper* cone tells the operator what speed to run when back gears are engaged. This system eliminates guesswork and the burning of drills, and prevents loss of time by the operator. An index is also placed on the feed rod which tells at a glance the proper feed for any size drill within the range of the machine. The feed is entirely independent of the drill spindle, and changing the speed of drill does not affect the feed arrangement. An automatic stop and depth gage throws out the feed after drill has reached the required depth.

The back gears are arranged so that one movement of a lever releases the cone from the shaft and engages the gearing and changes the feed ten times coarser, while one movement in the opposite direction disengages the gearing. The spindle is provided with means for compensating all wear which may take place in the quill, by means of a double conical bearing. Spindle head is vertically adjustable and can be raised or lowered and clamped in position. A square quill is used in place of the usual round sliding barrel. This adds greatly to the rigidity of the spindle in boring deep and rough holes, as it has more clamping surfaces and the barrel is less liable to gain play in the head.

Baldwin's Twenty Thousandth Locomotive.

The half-tone engraving and the line engravings on this and the following pages illustrate a ten-wheel four-cylinder compound locomotive designed by Mr. S. M. Vauclain and Mr. W. E. Symons, superintendent of the Plant System, for his company and built by the Baldwin Locomotive Works, being the twenty thousandth locomotive built by the company, completed last month. The special features of construction are the Vauclain four-cylinder balanced system of compounding, the Vanderbilt boiler and tender and the Symons boltless cast-steel truck. The locomotive weighs in working order 176,510 pounds, 127,010 pounds resting on the driving wheels. The wheel base of the engine is 28 feet 4 inches, of which the driving wheels cover 13 feet 9 inches.

RUNNING GEAR.

The driving wheels are 73 inches diameter; the centers are of cast steel with bronze hub plates; the tires are made by the Standard Steel Works and are of open hearth steel, 3½ inches thick, and held by shrinkage and shoulders; they are flanged 5½ inches wide. The main and parallel rods are in I-sections and are of forged steel. The engine frame is of wrought iron.

The engine truck is a four-wheeled swing bolster truck. The wheels are 33 inches in diameter, spoke centers of cast steel, made by the Standard Steel Works. The tires are of steel held by shrinkage and double lip retaining rings. The journals are 5½ inches in diameter and 10 inches long. The axles are of open-hearth steel.

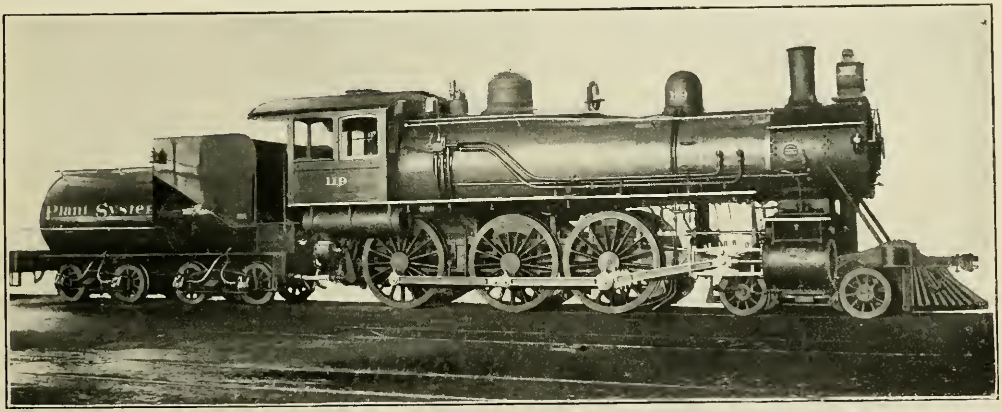
BOILER AND FIREBOX.

The boiler and firebox embody the invention of Cornelius Vanderbilt, M. E. The boiler sheets are of steel, 17 32 and 11-16 inch thick, having longitudinal butt seams, sextuple riveted and with welded ends. The lagging is of sectional magnesia and the jacket is of American planished iron. The boiler is 62 inches in diameter at the smoke-box end and is designed for a working steam pressure of 200 pounds. It was subjected to a steam test of 250 pounds and a water test to one-third above the working pressure. The boiler carries one helmet-shaped dome 30 inches in diameter, placed centrally, and an auxiliary dome near the cab furnished with two Coale 3½ inch muffled safety-valves encased with one relief valve set to 200 pounds, and a chime whistle. The smoke-box is extended, with spark hopper, netting and deflecting plate and has a cinder valve spout extending below the truck axle. The boiler contains 341 tubes of No. 11 wire gage, 2 inches in diameter and 15 feet long, made of solid drawn high carbon steel. The tubes are swaged for copper ferrules at one end. They are prossered at the firebox end, rolled at front end, and beaded on both ends.

The total heating surface of the boiler is 2,793 square feet, of which 128 square feet are in the firebox and 2,665 square feet are in the tubes.

The firebox, which is cylindrical in form with annular corrugations, is the special feature of the Vanderbilt boiler. It is of carbon steel, 131 inches long and 55 inches diameter inside, welded and corrugated by the Continental Iron Works, of Brooklyn. It is suspended within the cylindrical shell of the boiler with its axis eccentric to that of the boiler, in order to allow suitable steam space above the crown. The principal point of suspension is at the rear, where it is riveted to the back head of the boiler; it is also supported at the bottom by the reinforcing rings around the openings provided for cleaning the furnace—otherwise the firebox is entirely disconnected from the boiler shell.

By this construction all the flat surfaces ordinarily encountered in a locomotive boiler are eliminated, and the use of staybolts is entirely avoided. By doing away



VAUCLAIN'S FOUR-CYLINDER BALANCED COMPOUND.

with the staybolts a saving is made not only in the staybolts themselves, but the weakening of the plate, by reason of corrosion around the staybolts, especially where bad water is encountered, is avoided. By disconnecting the firebox from the outer shell, as is done in the Vanderbilt boiler, the destructive effects of contraction and expansion are reduced and the need of staybolts is entirely avoided.

The grate is designed for burning soft coal and contains 27.27 square feet. The firebox contains a fire-brick bridge wall against which the flames and products of combustion impinge and which prevents the flues from becoming choked by coal and cinders. The grate is made to rock in two sections and the ashpan has dampers front and back.

TENDER.

The tender is also constructed from designs of Mr. Vanderbilt. The circular form of tank is introduced principally on account of the economy of construction. Besides this advantage, however, it is found that the strength is greater in proportion to the weight, and that the capacity for fuel in proportion to the amount of water is larger than in the ordinary type, and the disposition of the fuel is more convenient. The tender carries nine net tons of coal and 5,000 gallons of water. The frame is of bulb angle iron.

There are two boltless cast-steel four-wheeled trucks constructed from designs of Mr. W. E. Symons, superintendent of motive power of the Plant System of Railroads. The side frame of the truck is of steel cast in one piece; the boxes are slipped into their openings and secured in place by keys. The truck frame is fastened to the bolster in a similar manner. The only nuts used are those at the ends of the keys. The wheels are 36 inches in diameter with cast-steel plate centers and steel tires, held by shrinkage and double lip retaining rings. The axles are of open-hearth steel and the journals are 5 inches in diameter and 9 inches long. They are fitted with an attachment for applying water for cooling the bearings.

CYLINDERS.

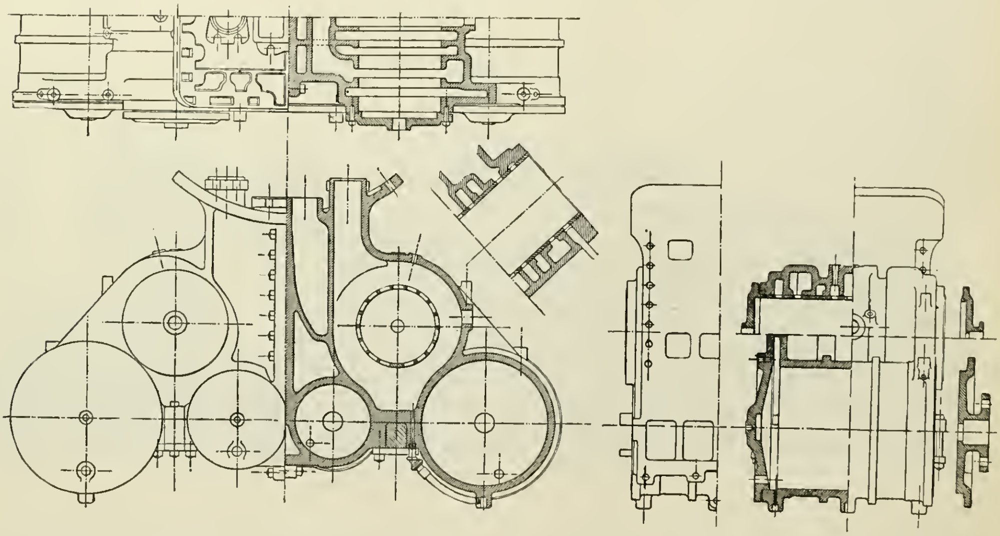
The most interesting feature of locomotive No. 20,000 is the latest form of the Vauclain system of compound cylinders. The cylinders are four in number, two high pressure and two low pressure. The axes of the four cylinders are parallel and in the same horizontal plane. The saddle is cast in two pieces, a high and low-pressure cylinder and valve chest in each piece. The low-pressure cylinders lie outside the frame and the high-pressure cylinders lie inside the frame on each side of the locomotive. The high-pressure cylinders are 15 inches in diameter and the low-pressure cylinders 25 inches in diameter; the length of the piston stroke is 26 inches. A valve of the balanced piston type, 15 inches in diameter, controls the passage of steam to each pair of cylinders.

The valves travel 5 inches and have an outside lap of 1 inch for the high-pressure and 7/8 inch for the low-pressure cylinders; they have an inside negative lap of 1/4 inch for the high-pressure and 3/8 inch for the low-pressure cylinders; the lead of the valves in full gear is high pressure, no inches; low pressure, 1/8 inch. In transferring the motion from the links to the valve rod, the links and the end of the valve rod are attached to the arms of an intermediate rock shaft, the motion being indirect. The eccentric throw is 5½ inches. The valve motion and connection are thus practically the same as in ordinary single-expansion locomotive practice, a single set of valve-motion actuating each side of the engine with its high-pressure and low-pressure cylinders.

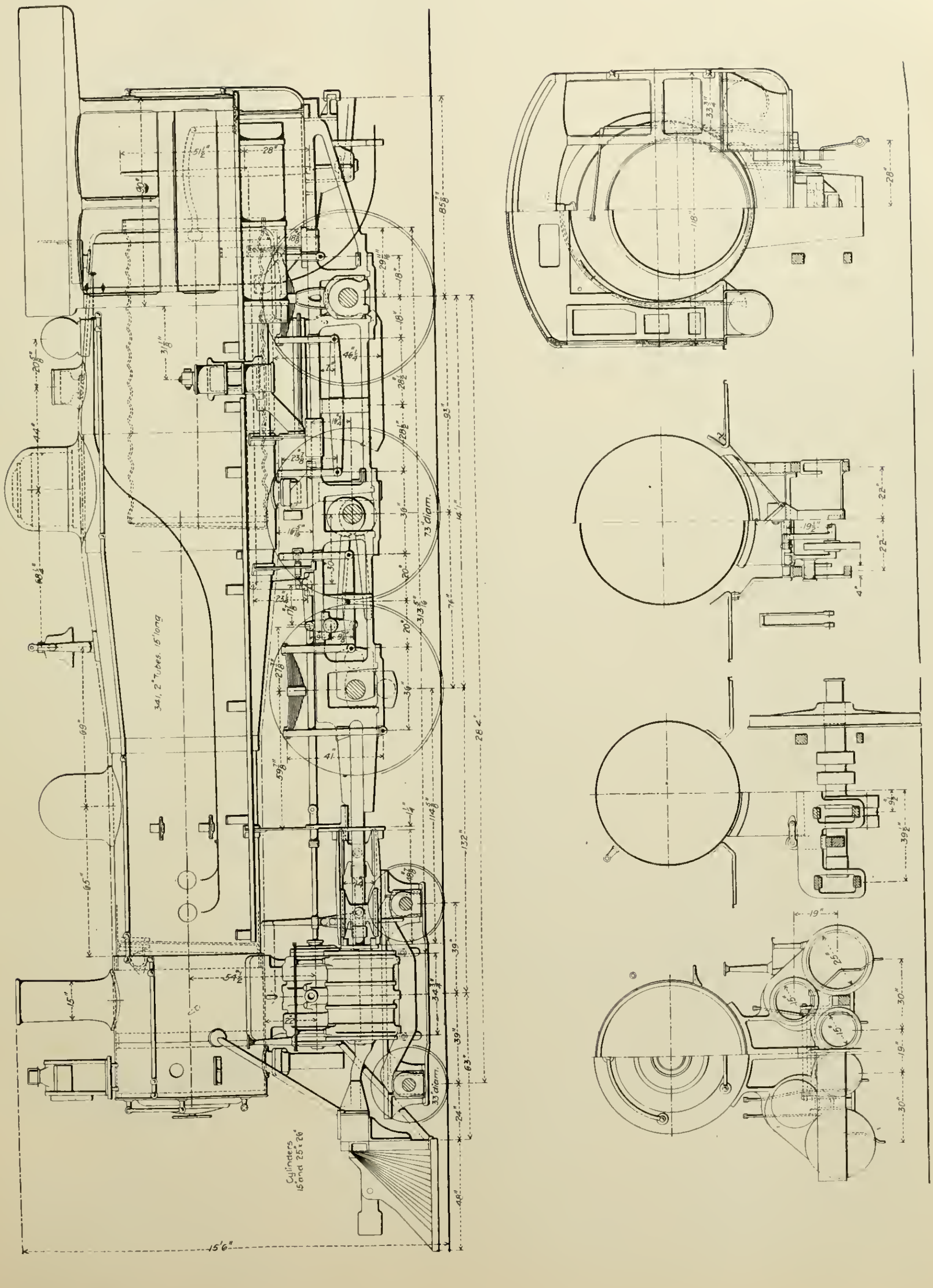
The four piston rods are of the same size, as small as possible, made of solid steel and the pistons are fitted with snap rings and Peacock packing ring joints. Each of the four pistons is connected with a separate crosshead, of the alligator type, working in separate parallel guides. The piston rods and other stems are all fitted with United States metallic packing.

The valve admits steam to the high- and low-pressure cylinders in such a manner that high- and low-pressure crossheads work in opposite directions, starting their stroke at opposite ends of the guides.

The crossheads are of open-hearth cast steel, with bronze shoes. The guides are of steel. The low-pressure crosshead and guides on each side of the locomotive are located outside the frames and the crosshead is coupled with the main driving wheel, which in this locomotive is the front wheel, by a connecting rod, as in ordinary practice. In addition, the main axle has two cranks set at right angles to each other, one on each side of the center of the locomotive, and each crank is coupled to a crosshead of one of the high-pressure pistons. The crank on the axle and the crank-pin in the wheel for the corresponding high- and low-pressure cylinders are set at an angle of 180 degrees; the two axle cranks being set at 90 degrees, brings the action of each high- and low-pressure cylinder on one side of the locomotive quartering with the equivalent cylinder on the opposite side.



CYLINDER ARRANGEMENT OF VAUCLAIN'S BALANCED COMPOUND.



VAUCLAIN'S BALANCED FOUR-CYLINDER COMPOUND.

The axles of all driving wheels are of steel, manufactured by the Bethlehem Steel Company. The steam passages in the cylinders are so designed that there are no pockets where water can collect.

Certain advantages are expected of this system of compounding, besides the recognized ones of economy of fuel and steam. The most important one is the fact that by a crank axle connected with pistons traveling in opposite directions from each other an almost perfectly balanced engine is secured. The main driving wheels are practically self-counterbalanced by the positions of the inside cranks with relation to the outside wrist-pins and their respective connections. It is only necessary to counterbalance such portions of the main wheels as are not sufficiently balanced by the cranks. The other driving wheels are counterbalanced each for its own rotating weight. As the reciprocating weights of the high-and low-pressure pistons and their connections move in opposite directions at the same time, they are within a few pounds of each other and the locomotive is only out of balance to that small extent. Thus we have a machine that will allow the maximum load on the driving wheels without detriment to the track, there being no unbalanced rotating weight in the wheels to either tend to lift the wheel or exert additional weight on the rail. As an offset to the objections pertaining to a crank axle and the duplication of guides, crossheads and main rods there is no variation in the vertical stress upon the rails, and consequently no need of allowing for it in the weight put on the driving wheels, the boiler can be made as large as the engine will carry, the speed of the locomotive is increased and it can attain its maximum speed with minimum risk. This combination of the large boiler with the perfection of balance makes the locomotive well adapted for drawing fast, heavy passenger trains.

It is difficult to grasp the vast amount of labor that has been expended on the building of 20,000 locomotives. All great works built by human hands, such as pyramids, temples and cathedrals sink into insignificance compared with the skill and labor expended upon the construction of 20,000 locomotives. Reckoning the length of engine and tender as 50 feet, the engines put on end would make a train 1,900 miles long—a train that would stretch from New York to Denver. The weight of these engines if converted into rails of 60 pounds to the yard would be sufficient to lay 10,000 miles of track.

The special equipment used on the engine are: Janney coupler with hinged head, Golmar automatic bell ringer, one Hancock injector, one Nathan injector, Crosby vertical reading gauge, Pyle National electric headlight, Westinghouse-American brake, Gold system of steam heating.

Stevens Institute.

The secretary of the American Railway Master Mechanics' Association has announced that there will be a vacancy for one scholar next June in the Stevens Institute of Technology, Hoboken, N. J. Candidates ought to apply soon, as the entrance examination will be held in the Institute in June.

There was an interesting event happened at the Institute last month, when Mr. Andrew Carnegie opened a laboratory of engineering which he had presented to the Institute. In his address Mr. Carnegie said that his company was the first steel-making concern to employ a chemist, and that chemist was imported from Germany. Although their rivals laughed at the idea of employing a chemist, they obtained richer and cheaper ores than others, through the knowledge possessed by the chemist.

After the opening ceremonies the alumni of Stevens Institute gave to Mr. Carnegie a section of the first T-rail rolled from a pattern made by Col. Robert L. Stevens, founder of the Institute.

A few days later Mr. Carnegie sent a check for $100,000, to be spent on maintaining the laboratory.

Report on New York Central Tunnel Accident.

The Railroad Commissioners of New York State have been investigating the tunnel accident on the New York Central Railroad, which we commented on last month, and they have made some recommendations for the purpose of promoting safety in the future operating of trains through that tunnel which we consider absurd. They recommend reducing speed in the tunnel to 24 miles an hour, which will, if carried out, increase the congestion of trains during busy hours. They have recommended that one block shall be abolished, which will also tend to delay the movement of trains. They have recommended that an engineer new to taking passenger trains through the tunnel will be piloted 100 times before he is permitted to do the work alone, which is simply ridiculous, and never would have been made by men who thoroughly understood railroad operating.

The Buffalo Forge Company's Salesmen.

The practice of getting together the salesmen and representatives once or twice a year seems to be growing, and will, we believe, be productive of good results. The exchanging of ideas and methods is a good thing in any business and brings many plans of action into general use which would otherwise be confined to one agent or locality. Then, too, the competition of ideas develops resources in anyone; all of which help the business and all concerned.

There were twenty-six men, including both W. F. and H. W. Wendt, the proprietors, and they represent a force which is working for better heating and ventilating and other improvements in their line. This includes down-draft forges, high-speed engines of various types and other modern machinery. We believe these gatherings will become more and more frequent as their value becomes known.

Putting Botches to do Mechanic's Work

On a great many railroads there is no end of trouble with the metallic gland packing of piston rods, valve stems and air pumps. By a curious coincidence on most of the roads where trouble with metallic packing is epidemic there are complaints about triple valves, air pumps and every detail of engine and train mechanism that needs regular attention The fact is that chronic trouble with the more delicate parts of engine and train mechanism means incompetence on the part of the men in charge. That condition of affairs generally exists on roads where immediate cheapness is worshipped in preference to skillful work. Workmen with no manipulative skill are put to do delicate fitting that can only be done properly by trained mechanics, and very frequently the man in charge boasts that he is getting his mechanics, and very frequently the man in charge boasts that he is getting his work done cheaply. It is done cheaply in the first place, and like other cheap jobs is ruinously dear in the end. When an engineer has to work at every stopping place to adjust glands to prevent the steam from blowing through rod packing, the extra work put upon the engine and the loss of time are only a small part of the loss that devolves upon the company. But the man responsible for the most harassing kind of extra labor and delay sits complacently in his office and boasts that he is getting three-dollar-a-day work done by dollar-and-a-half men.

From ocean to ocean in three days is the time the Canadian Pacific expects to make early in the spring. Equipment for the new service will cost the system nearly $1,000,000, and will be supplied by builders in the United States. This service will be in addition to that formerly operated, and the new train will be tri-weekly. The Canadian Pacific will cut twenty-four hours from the running time, making a seventy-two-hour schedule between Montreal and Vancouver. The average running time will be 40.3 miles an hour. The train will make no local stops whatever.

According to the report of the Interstate Commerce Commission, the year 1901 was an unprecedentedly prosperous one for the railroads of the United States, the net earnings of these roads amounting to about $555,007,924, or $35,577,218 in excess of their earnings during the fiscal year of 1900.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(108) G. S. M. asks:

What is the combustible substance of oil? A.—The combustible substance or portion of any fuel is *carbon*, or carbon and hydrogen.

In question No. 105 the drivers should have been 56 inches in both cases, instead of 50 in the first instance. This answers the question of J. J. G. F., who called our attention to the error.

(109) C. F. D. writes:

My injector wastes water and steam at overflow when working, and I cannot adjust it so it will not. What ails it? A.—Discharge tube is probably worn too large for steam tube and causes waste at overflow.

(110) J. S. W. asks:

In case of broken main crank pin, making it necessary to take down all rods on that side, is it necessary to take down side rods on other side to take in light engine? A.—Yes. See article regarding it in this issue.

(111) C. H. S. asks:

How can I disconnect an engine with a piston valve? A.—Same as any other engine. Blocking valve in center will cover all parts whether it is internal or external admission, and you can then disconnect as with any engine.

(112) S. F. H. asks:

What is steam? A.—While a long dissertation might be written on this, we can say, briefly, that it is a vapor generated from water by boiling or applying sufficient heat to it. 2. What is the difference between a lifting and a non-lifting injector? A.—As the names imply, the lifting injector lifts the water from a lower level as well as forces it into the boiler. A non-lifter has no lifting jet and requires water to flow to it.

(113) J. A. B. writes:

Will you please tell me what number of years is considered the life of a locomotive boiler in constant service under ordinary conditions—that is, with fairly good water? A.—The life of a boiler does not depend so much on the number of years it has been in use as the number of heat units it has had to generate in the making of steam. With somewhat extensive repairs the ordinary locomotive boiler will be good for about twenty years' service and will make 800,000 miles in train service.

(114) G. H. P.: Does a four-cylinder compound work simple? A.—Yes. You probably refer to the Baldwin or Vauclain type. These can be worked simple on starting, in which case the steam is not used in high-pressure cylinder (circulating from end to end through the by-pass), and the low-pressure does the work with a steam pressure reduced by wire-drawing. Tandems generally use live steam in low-pressure only when starting. 2. Does the reducing valve work automatically in any class of compound? A.—Yes, in all that use it. Perhaps you mean the intercepting valve. This works automatically in most types.

(115) A. A. P.:

If I found an over pressure of 50 pounds on my boiler (stationary—set to blow at 100 pounds) could I raise safety valve without any damage, there being a heavy fire in the boiler? My friend says I should deaden fire and wait till pressure was very much reduced. A.—Unless you wish to join the angels by the explosion route, follow your friend's advice. The temperature of the steam and water at 150 pounds pressure is 365 degrees, while at 100 pounds it is only 337 degrees. When you raise safety valve you reduce pressure of steam suddenly, and the water at 365 degrees immediately flashes into steam at the lower pressure and usually with bad results.

(116) D. C. M. writes:

1. What would you do if you broke a front side rod on a consolidation engine? A.—With the knuckle joint in the usual place (in the front rod), ahead of pin in second wheel, take down *both* front rods and run in. 2. What should be done if a middle connection broke back on a consolidation engine? A.—If the knuckle joint is in that section, take down the front and middle section on both sides. If the knuckle is in back rod, take down all side rods and run home. 3. What would you do if you lost collar off front pin on a six-wheel connected engine? A.—As the knuckle joint is nearly always in the back side rod, taking off the front rods means making the engine into a "single pair of drivers." But unless some means of keeping the rod on the pin can be found, this must be done.

(117) H. G. G., Calgary, Alberta, writes:

Will you favor me with your experience and explanation of what is crystallization of metal—we will say a car axle or locomotive axle? A.—Crystallization is the tendency of some substances to separate from surrounding matter and form minute entities that contain restricted elements. In iron and steel certain conditions, such as protracted vibration, lead to crystals being formed which contain selected elements that have no affinity for surrounding substances. In crystallizing to form, ice water rejects all impurities such as lime, salt, magnesia, etc., and the ice is pure water. The same thing happens when metals crystallize. The act of crystallization throws off carbon, manganese, sulphur and other elements that enter into the constitution of steel or iron. The act of crystallizing takes away the homogeneousness or fibrous character of a metal and robs it of its tenacity, the crystals having reduced adhesive properties for matter outside of themselves.

(118) T. S. H.: How is it that an engine increases in lead by hooking up? A.—This was explained in the article on "Valve Motions," on page 272 of the issue of June, 1901. Briefly, it is because the link is influenced by the two eccentric rods which swing from different centers. 2. Why do you advise taking off both side rods if one is disabled? A.—With one side rod left on, and that one on the center, there is nothing to force it to turn the second wheel in the right direction. While it will usually do so, it is very risky, and many a crank pin has been sheared or bent by it. We know of one case where an engine was run successfully in this way for a number of miles, but on running on the turntable at the roundhouse, the wheel "balked," and a bent crank pin was the result. 3. How would you set slipped eccentrics on the road? A.—A rough rule is to bring the eccentrics to the same side of the axle as the crank pin. Put the go-ahead eccentric above the crank pin about 60 degrees and the backing eccentric an equal amount below it. This will get you home, and applies to slide valve engines with a rocker as usually found.

(119) H. S. F.: Please describe the intercepting valve of a Pittsburgh compound. A.—In this engine the intercepting and reducing valve is on the high-pressure side; nearly all the others have it on the low. This makes it independent of receiver pressure, so that it never goes into compound except when engineer hooks up or puts it in that position independently. The intercepting valve allows the steam pressure which has been admitted through the reducing valve to go through the receiver pipe over to low-pressure cylinder, and at the same time opens an independent exhaust passage for the high-pressure cylinder. In compound position it closes this auxiliary exhaust and the reducing valve shuts out live steam, while high-pressure exhaust must go to low-pressure cylinder. The action of reducing valve will be explained elsewhere. 2. What should I do in case of breakdown on either side? A.—Place intercepting valve in simple position or at back end of intercepting valve chamber. If low-pressure side cannot be used, block reducing valve so it cannot act. To do this, remove spring and put in a clamp of wood or iron to screw lock nut against, so as to hold valve securely to seat.

Pensions for Lackawanna Employes.

The announcement has been made that the Delaware, Lackawanna & Western Railroad Company have arranged a pension system for the benefit of the employés of the road which went into operation on March 1st. An originial and peculiar feature about this pension system is that those who will reap its benefits are not required to contribute part of their wages to make up the fund from which the pensions will be paid.

Under the system adopted any employé engaged for twenty-five years in any capacity in the operation of the railroad proper, who has faithfully performed his duties, is to be retired at the age of sixty-five and to receive thereafter a monthly allowance dependent on his pay and length of service. The amount of pension will depend upon the actual time of service and the employé's average regular monthly pay for the ten years next preceding his retirement.

Thus, if the monthly pay has equaled $60 a month and the time of service thirty years, the pension will be $18 a month, equal to 1 per cent. a year for thirty years of an average monthly wage of $60.

Retirements under the system will be voluntary and involuntary. All employés sixty-five years old and over will be considered as having attained the maximum age limit for active service and will be retired on pension if they have served twenty-five years or more, while those whose ages range from sixty to sixty-four years, inclusive, and who in the opinion of the pension board have become physically or otherwise permanently incapacitated after twenty-five years of service may be either voluntarily or by decision of the board retired and pensioned. In case of injuries to employés the board has power to consider the cases, award pensions, if merited, and fix the period of payment.

The working of this pension system is certain to greatly strengthen the close ties already existing between the management and the employés.

The board of officers selected to administer the affairs of the pension department, under the direction of the president of the company, are General Superintendent T. E. Clarke, General Auditor O. C. Post, Chief Engineer W. K. McFarlin, Superintendent of Motive Power and Machinery T. S. Lloyd, and Traffic Manager B. D. Caldwell. At the organization of the board, Traffic Manager Caldwell was elected chairman, and General Auditor Post, secretary.

Baldwin's Seventieth Anniversary.

Record No. 32 of the Baldwin Locomotive Works is called "Seventy Years of Locomotive Building" and contains a brief history of the works from the time when the Old Ironsides was built in 1832 up to the time the 20,000th engine was turned out last month. It also contains description and illustrations of No. 20,000, which is the ten-wheeler built for the Plant System of Railroads, a four-cylinder compound with two high-pressure cylinders connecting with cranked axle and two low-pressure cylinders outside connected. The engine was designed by Mr. W. E. Symons, superintendent of motive power of the Plant System, and has a Vanderbilt boiler and tender.

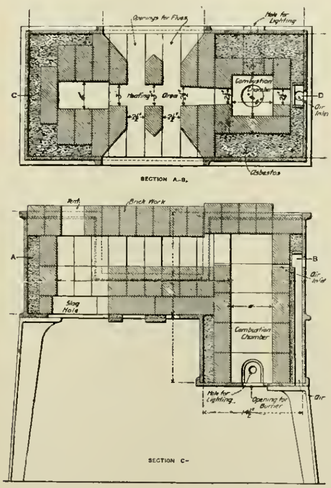
Messrs. Burnham, Williams & Co. gave a banquet at the Union League, Philadelphia, to commemorate the completion of the 20,000th locomotive and the seven-

tieth year of continuous operation. A most distinguished company was present and several very interesting addresses were made which we will notice at length in our next number.

Saving Money in Flue Work.

One of the heavy items of expense that accompany the introduction of the very heavy locomotive is that of flue work. Some of the larger shops have to meet a demand for 5,000 to 7,000 flues per month, and this takes quite a force of men when only 125 to 150 flues per day can be turned out with a furnace using hard coal or coke. Here is where the oil furnace gets in its fine work, but it must be remembered that all oil furnaces are not alike, even if they do look similar.

The Ferguson furnace is built on a different principle from the others, in that the oil flame does not come in contact with the work at all. Instead of this there is



FERGUSON OIL-BURNING FLUE FURNACE.

a combustion chamber provided at one end, as shown, and the fire is in this end while the hot gases pass over and around the flues or other work to be heated. This keeps them free from oil or other deposit and in the best condition for welding. The oil is fed to burner by gravity (when convenient—otherwise it is forced there) and controlled by a small needle valve. This and an air blast of 8 ounces are all that is needed to secure the desired result.

With one of these furnaces it is an easy matter for one man and a helper to handle 500 to 600 flues per day, and there are cases where 100 an hour have been welded in emergency work. This requires the consumption of about 25 gallons of fuel oil per day of ten hours. It has the advantage of being free from phosphor and sulphur, so that there is no oxidization.

Any doubt as to the heating property of the furnace on account of the combustion chamber being away from the work is removed when we learn that it takes only 40 seconds to heat a flue to the welding point and 60 seconds will melt a flue end.

With these points in its favor it is not surprising that many of the best railroads have adopted them, among them being the Pennsylvania, Chicago & North Western, Delaware & Hudson, Wabash, Lake Shore & Michigan Southern, Mobile & Ohio and others. The Ferguson furnace is made by the Railway Materials Company, Old Colony Building, Chicago.

Attractions of Atlantic City.

If the query was made, Which is the most widely known resort in the world? without hesitation the answer would be Atlantic City. Atlantic City gained its renown through its aggressive up-to-dateness.

Its position is unique, its attractions without equal, its hotels so numerous as to care for a hundred thousand visitors, its beach can accommodate multitudes, and its board walk is the greatest in the world.

Couple these to a fine climate, unlimited diversions and exceptional train service and you have the reason for Atlantic City's popularity.

The New Jersey Central can take you to Atlantic City on trains than which there are none finer; no quicker time can be made than it makes, and upon application by postal card, C. M. Burt, G. P. A., Central Building, New York, will send you a folder of rates, trains and maps. Send for it.

Pennsylvania's Activity.

Few railroad men even realize the immense amount of money being spent by the Pennsylvania Railroad for improvements and betterments. Besides the hundreds of locomotives and thousands of cars being constructed in its own and other shops, stupendous track and right-of-way improvements are being made, such as elevating tracks through cities, diverting freight traffic outside and around city limits, abolishing grade crossings, straightening tracks and reducing curves, etc., to say nothing of its New York city tunneling and terminal plans. In numbers of places the road is on its fourth and fifth location, and the end is not yet in sight. It is this restless spirit of progressive activity that is rapidly pushing the Pennsylvania forward into the foremost rank of the world's railroads, and has eliminated from its lexicon the waterlogged, barnacled, incubus phrase, "Let well enough alone."

The Best Manufacturing Company, Pittsburgh, Pa., have published a neat illustrated catalogue showing stand pipes and valves used at water stations. People connected with railroad water supply matters will find the catalogue a useful reference.

A Record Breaking Run.

The *Boston Herald* sent out one of its experts to write up a long account of President Roosevelt's trip from New York on a special train, on the way to see his sick son, and it resulted in an article which must be very amusing reading to practical railroad men. Of course the run of the train was called a record-smashing run, and it really was so for the New York, New Haven & Hartford Railroad. We are told that engine No. 245 with 200 pounds of steam started to make the most phenomenal run ever made between New York and New Haven, and that the distance of 74 miles was covered in exactly 83 minutes.

Engine No. 132 was in readiness to take the train to Providence, a distance of 116 miles, which was covered in 118 minutes, the throttle of the locomotive, we are told, having been pulled out to its limit. At Providence, the report says, "Engineer Winslow leaned out of the cab of '537,' anxious to catch the first rumble of the President's special. The moment it was heard he sprang from his seat and took firm hold of the throttle valve. After linking up with the President's car, Winslow, under instructions to reach Boston in the quickest time possible, threw his reversing lever hard over and gave '537' all the energy that the boiler could exert. It was 12:02 when the steam was let into the cylinders and it was 12:48 when it was shut off in the train shed at the South station." The 44 miles were run in 46 minutes. We feel about this run as Dominie Simpson did when he saw or heard of anything extraordinary, and vent our feelings by his expression, "Prodigious!"

Good Positions Open.

There are excellent positions for two first-class men open if they can be found. They must be mechanical men who have run locomotives, and they must be able to talk French and German. They are required to introduce the goods of a first-class American house on the Continent of Europe. Men who can fill the bill should apply to this office, giving an outline of their experience. No one need apply who cannot talk French and German. Single men will be preferred.

There is a joke going the rounds of a great railroad center, that the big freight locomotives belonging to a certain company are noted for having more fire in their smokebox than in the firebox. This means that there are air leaks in the bottom of the smokebox which supply the air necessary to sustain combustion. If the men in charge would plaster the smokebox seams with Eureka Steam Joint Cement the smokebox would be air tight and there would be no fire. A valuable property about this material is that it does not burn out. It is a refractory silicate of aluminum which withstands heat as well as firebrick. It is much cheaper than red lead and superior to it in every respect when high temperature has to be resisted. We have been familiar with its use for many years and never knew it fail. Send to the Otley Cement Company, Chamber of Commerce Building, Chicago, for a sample.

A Bridge Hard to Keep from Corroding.

The Joseph Dixon Crucible Company, Jersey City, N. J., give interesting information concerning the protective painting of the Union Railroad Bridge, which crosses the Monongahela river at Pittsburgh (Rankin), Pa.

The associate engineers were Messrs. Emil Swensson, designer and engineer of construction, and Wm. H. Smith, chief engineer Carnegie Steel Company. The total weight of this bridge is 5,135 tons, and it has a total length of 2,328 feet.

Designed for carrying molten metal from the Carrie Furnace to the steel mill and raw materials to the furnaces, this notable steel structure is subjected to heat from the molten metal, sulphur fumes from locomotives and river steamers, also from the adjoining furnaces and steel mills.

No other steel bridge in all the world is exposed to so many and severe destructive agencies. The best metal preservative was necessary, and the eminent engineers selected for its protection Dixon's Silica-Graphite Paint, as manufactured by the Joseph Dixon Crucible Company.

Reports come from the West that some of the huge locomotives sent out there during the last few months have punctuated their journeys by bending a great many rails and breaking others. In spite of the protests that railroad officials have recorded, some of the engines were sent on their long journeys with the side rods down. Some of the railroad companies refused to permit the engines to go over their lines until the side rods were put up, which was a sensible proceeding. The surprise to us is that any railroad company will receive a locomotive in transit which has its side rods down.

The Standard Pneumatic Tool Company, Chicago, have appointed Mr. J. B. Wilson, formerly connected with the mechanical department of the Grand Trunk Railway, manager of their new Canadian offices, which they have just opened at 103 Union Station Arcade, Toronto, at which place they will carry a full line of their "Little Giant" pneumatic tools and appliances, repair parts and accessories. In the future all machines for Canadian customers will be shipped direct from their Toronto office, thereby saving purchasers the inconvenience of making out manifests and paying duty.

Ton-Mile System in India.

We Americans are inclined to boast of having originated nearly all improvements in train operating which have resulted in the acceleration of trains and in reducing the cost of operating, but a claim comes from India for having originated the practice of ton-mile rating, which we have been in the habit of regarding as essentially our own. Notes published by *Transport*, from Sir Richard Strachey, who was for years Secretary of the Public Works Department of India, which exercises control over the railways, claim that in 1872 a system was introduced of making weekly reports of the ton-miles performed and the number of cars employed in doing the work. By this means the responsible officials were able to keep a constant check upon the tendency to run underloaded cars and underloaded trains.

The British railway officials are gradually adopting the ton-mile system as a means of reducing the cost of moving freight, but they are working out the system on information obtained from America. When a British railway manager of progressive tendencies wishes to find out the best methods or the best machinery for reducing the expense of moving passengers and freight, he looks to the United States for inspiration. That is complimentary to us, but it is barely fair to India, where progressive tendencies have always been stimulated by poverty.

The annual report of the Delaware, Lackawanna & Western is a thorough vindication of the line of modern management inaugurated by President Truesdale. It took some years to prove the advantage of the changes introduced, but they are apparent enough now to convert the most captious critic. In his report President Truesdale shows that during the past year the company has spent an average of $250,000 a month for betterments out of current earnings. The company's output of coal increased from 6,013,849 tons in 1900 to 7,531,735 tons in 1901. The volume of passenger traffic on the Lackawanna last year is reported to have exceeded all previous years.

The Austrian State Railroads have ordered two railroad automobiles to run on lines where travel is light. Each is to carry eighty passengers. One is to be run either by electricity or naphtha, the other by naphtha alone. Many of our railroad companies are anxiously looking for means to compete with the trolley cars in the hours when business is light and it will not pay to run a heavy locomotive and all its attendant expense. What is to prevent them trying a powerful gasoline motor car. Various races have proved that the gasoline motor has speed possibilities that ought to satisfy the most exacting suburbanite.

Correspondence School Moving Its Quarters.

The Chicago offices of the Railway Department of the International Correspondence Schools, which have been located for several years in the Manhattan Building, have become too small for the increasing work done by the institution, and they are about to be moved to very commodious quarters on North Clark street, corner Chicago avenue. Offices and instruction plant will be located on the fourth floor of the Bush Temple of Music, a palatial building whose magnitude may be inferred from the fact that the school will have 5,500 square feet on one floor.

The appliances used for instruction in the Manhattan Building rooms are very numerous and elaborate, but the new rooms will have a still better equipment arranged just to suit the convenience of the men in charge. It is expected that the entire plant will be in working order in the new building by April 1st, and railroad men are cordially invited to call and see it for themselves.

The German Yacht Hohenzollern.

The United States Metallic Packing Company have just completed the work of applying their packing to all the engines of the German Imperial yacht "Hohenzollern." They have supplied a large quantity of extra material which will be sufficient to supply repairs for many years.

Several of the boilers of the "Hohenzollern" have been equipped with oil-burning boilers since the vessel entered the port of New York, and she has been equipped with storage tanks for the oil.

Some experiments have been carried out on the Illinois Central Railroad lately to use the ordinary telegraph wires for the purpose of communication by telephone. The invention put to tests was designed for enabling trains that were stopped between stations by accident to communicate with points where help could be secured. A long rod is hooked over the telegraph wire and the instrument to be used is ready for business. The tests worked fairly well.

The result of the visit of Mr. G. S. Gibb, general manager of the Great Eastern Railway of England, and the leading members of his staff to the United States a few months ago has been that they have adopted our system of tonnage rating of trains, and they are busy making other changes to follow United States methods.

Our supply of passenger car charts is completely exhausted, so that no further orders for it can be filled. We still have the locomotive chart and the color picture of the Modern American Passenger Locomotive. The former is 25 cents, the latter 15 cents, mailed in tubes.

Locomotive Building in the United States.

BY FRED H. COLVIN.

(Continued from page 62 ante.)

Moore & Richardson were located in Cincinnati, O. They built a large number of engines in their time. Most of them were fitted with the "Gooch" link, as it was considered by them a strong point to have a uniform lead for the valve. They also used a "bell stand" of same pattern as now in universal use by all builders. They were in the flood tide of their business in the fifties, having great hopes of holding out against the Eastern shop.

Danforth & Cooke, of Paterson, N. J., were well known among the early builders, and, after several changes, became the Cooke Locomotive & Machine Company, now one of the eight plants of the American Locomotive Company. Established in 1851, they were very prominent for many years, and a "Cooke engine" was often recommendation enough to a railroad man.

The Erie Railroad Company, soon after the opening of its road from Hornellsville, N. Y., to Dunkirk, N. Y., in 1852, constructed in Dunkirk a locomotive repair shop. In 1869, when Jay Gould, then president of the Erie Railroad, had completed extensive shops at a more central location on the line of that road, he ordered the Dunkirk shops to be permanently closed and the machinery removed to other localities. Mr. Horatio G. Brooks, then superintendent of motive power and machinery of the Erie Railroad, whose home was at Dunkirk, and whose interests were identified with its welfare, made a proposition to Mr. Gould for a lease of the shops and machinery for the purpose of establishing the business of locomotive building. The lease was consummated in November, 1869, and before the close of the year the first two locomotives of the new Brooks Locomotive Works were turned out.

The Essex Locomotive Works were established in Lawrence, Mass., prior to 1853 (the exact date is in doubt). Mr. Charles Hastings was chief draftsman, and they built at least two locomotives, the "Essex" and "Lawrence," for the New York Central, which had independent cut-off valves. Little else is known of these works.

The Detroit Locomotive Works were at Detroit, Mich., in 1853-4-7, etc. They built a number of engines which the boys called the "Wolverines." They were mostly for the Michigan Central and Great Western of Canada. Mr. Carpenter was foreman, afterwards master mechanic of the Detroit & Eel River road.

Smith & Perkins were at Alexandria, Va., and their engines were quite well known in some localities in about 1853. Thatcher Perkins was superintendent, formerly master mechanic of the Baltimore & Ohio. Only a few engines were built there, all of which were designed by Mr. Perkins. Some of the first engines were for the Orange & Alexander and the Manassas Gap Railroads.

The Cuyahoga Steam Furnace Company were in Cleveland, O., and have quite a history, if it could all be written. Mr. E. T. Sterling was superintendent; Mr. Rogers, foreman, in 1853. A patent cut-off by Rogers was a strong feature of the many engines built then.

Breese, Kneeland & Co. were at Jersey City, and one of their old engines, the "Superior," was shown in our issue of November, 1898. Mr. E. P. Gould was superintendent. Some of the special features of the engines were a solid forged "slab frame," short travel of valve, some of which was only 3½ inches. A Mr. Hamilton was mechanical engineer of the works. They commenced building engines in 1853.

The East Bridgewater works are described as follows in a letter to the author by Mr. George Duckworth, who is familiar with their history: "The Matfield Manufacturing Company, of East Bridgewater, was formed in 1853 by James Brown, Wm. Bates, Franklin Keith and others, to engage in building locomotive engines. The stockholders were mostly residents of East Bridgewater. Mr. Brown was agent and general manager. The master mechanic was Elias Woodworth, who had held a like position in the repair shops of the Old Colony Railroad in South Boston, also at John Souther & Co.'s Globe Works. For the wheels, frames and other heavy work and the erection of the engines, Bradbury E. Randall and his two sons, Samuel A. and William B., from Wm. Mason Locomotive Works, were employed. They were previously at Hinkley & Drury's. Eben J. Lothrop and Stephen Cairns built the cylinders, pistons and connecting rods; they were formerly employed at Southers. Stephen A. Morse, formerly of Hinckley & Drury's, made the lighter running work, employing his brother, Rufus W., from Colts Armory, as toolmaker. Mr. Morse subsequently established a twist drill manufactory at New Bedford. He died December, 1898. The boilermaker, Charles Gibbs, and the blacksmith, Jeffrey Cole, were from Boston shops. Each of these 'job hands' hired his own help, and executed his part of the work at a fixed price per engine. Probably not more than fifty men were employed at one time. There were six engines built. The first was called 'Charles Phelps' and was sold to the Providence & Stonington Railroad. The second was named 'Daniel Webster' and went to the Cape Cod Railroad. On the tender was painted an enlarged copy of a popular picture, called 'Webster at Marshfield,' representing the great statesman sitting under a large tree. The third was not named by the builders, but was by 'the boys' as the 'Know Nothing,' a popular political word of that day. On the tender of the other, that was intended to be named the 'Amazon,' was portrayed a beautiful though scantily attired woman bestride a most

noble horse. The fourth engine was built to fill an order that Mr. Woodworth had obtained from his native city, Halifax, Nova Scotia. It was named the 'Mayflower,' and when finished, the company having exhausted their resources of capital and credit, he decided to go with it as its engineer. The company soon afterwards went out of business, leaving two unfinished engines in the shop, that were completed under direction of the assignees and sold to the Old Colony & Fall River Railroad, and named 'South Boston' and 'New York.' The unnamed engine caused the instant death of Stephen Woodworth, and the 'Mayflower' jumped from an ice-covered track into the deep waters of the Atlantic Ocean, carrying to his death her ill-fated constructor. Among the more pleasant memories of Matfield was the trial trip of the 'Charles Phelps,' when three carloads of jubilant citizens of the village were given a free excursion to Plymouth, hauled by the newly completed 'iron horse,' of which all were proud. The dates and other points were given me in this matter by the courtesy of Herman S. Morse, Esq. I am and have been continuously employed on this railroad since 1847, and well recall the movements of this company, being engineer on the locomotive 'Pawtuxet' in 1855. I am reminded of moving the 'Webster' and other engines mentioned."

Swinburne is another name which is well remembered, but little actual knowledge can be obtained. It started as Swinburne & Smith, but the former soon withdrew and started Wm. Swinburne & Co., Paterson, N. J. This was short-lived, however, being crushed by the panic of 1857.

The White River Junction Locomotive Works, at White River, N. H., were also in the field in about 1857. They built engines very much like the Taunton. One of them was the old No. 5 on the Toledo, Peoria & Warsaw road. Only a few were built before they became one of many failures in the field.

The Dickson Works, of Scranton, Pa., now a part of the American Locomotive Company, were started in 1857 by William Cooke & Co. and known as the Cliff Locomotive Works. They built three locomotives. The first one was a 4-wheel connected passenger with a 4-wheel truck, and is called "C. P. Wurts, No. 1," and was for 4-foot 3-inch gage, to be used on the old Delaware & Hudson gravity, which was abandoned in the spring of 1899. The other two locomotives built by this company are still in existence at Honesdale, owned by the same company. In 1858 they rebuilt a lot of engines, known as the "cabbage cutters" for the Delaware, Lackawanna & Western Railroad. Their first standard engine was the "Erie," which was No. 16 on the Lackawanna & Bloomsburg road. This was delivered early in July, 1863. It was a ten-wheel, 17 x 24-inch engine, with 54-inch drivers, and had a pump on one side and injector on the other. In 1862, the Dickson Manufacturing Company, which began in 1856 as Dickson & Co. and was incorporated in 1862, purchased the works of Wm. Cooke & Co. and began the manufacture of locomotives, which they have continued ever since.

The Risdon Iron and Locomotive Works, San Francisco, Cal., were organized in about 1859 under the firm name of Coffee & Risdon, who started in as boiler makers. Their business grew to such an extent that they formed a stock company known as the Risdon Iron & Locomotive Works. During the first few years of the corporation's existence, they constructed some three or four locomotives for logging purposes, also a few dummies for small suburban roads. The last locomotive was built in about 1884, for a firm in Alaska. It was of the geared type and ran on wooden rails. The company failed and the builders did not get paid for the engine.

The firm of H. K. Porter & Co. began business in 1866, under the name of Smith & Porter, with a shop of one rented room in Twenty-eighth street, Pittsburgh, Pa. There were a man and a boy, besides the "firm." They grew fast, however, and soon built a shop of their own. On March 4, 1867, the first locomotive was contracted for, and shipped on Thanksgiving Day. It was a four-wheel saddle-tank engine, 42-inch gage. In February, 1871, the shop was burned, and on rebuilding the firm name changed to Porter, Bell & Co., which lasted until the death of Mr. Arthur W. Bell, in 1878, when the present firm name was adopted. They have built everything from 18 to 72-inch gage and from 4 to 45 tons, and for all parts of the world.

The New Jersey Locomotive & Machine Company was changed to Grant Locomotive Works, 1866.

The Lancaster Locomotive Works, Lancaster, Pa., were also Norris works, as they were run by James Norris. They built the "Ant" and the "Bee," the first decapods, for Alexander Mitchell, master mechanic of the Lehigh Valley, in 1867. J. A. Durgin, "constructor," also built engines for the Pennsylvania Railroad.

The National Locomotive Works at Connellsville, Pa., were run by Dawson & Bailey in 1870. They were started for the purpose of building narrow-gage locomotives, a "mania" just getting hold of the railway world at that time.

Kentucky Locomotive Works, Louisville, Ky., were run by Messrs Olmstead, Tenney & Peck. Exact date is not known.

Richard Norris & Brother had quite a shop in Philadelphia, but their engines are now only a memory. The Norris Brothers, however, left their mark on the locomotive business of the United States, and deserve much credit.

The Trenton Locomotive Works, Trenton, N. J., were organized by Van Cleve & McCann. Afterwards Mr. Isaac Dripps left the Camden & Amboy Railroad to join them and became one of the firm. They built the "Monster" class of

engines for Camden & Amboy and Belvidere & Delaware Railroads, also standard eight-wheelers, with valve motion outside. Mr. Adams was superintendent in the later part of its existence.

The Niles Locomotive Company were in Cincinnati, O., but did not build locomotives very long. They are now at Hamilton, O., and the tools of the Niles Tool Works have a world-wide reputation. Two of the engines built by them had four cylinders and were fitted with "Walschaert" valve gear, for outside cylinders. Some of their 15 x 22 engines had steam ports 18 inches long, 1⅜ inches wide—a "hobby" with them.

Among the works about which little or nothing has been learned are: John Souther & Co.'s Globe Works, Boston, Mass.; Hawood & Bartletts, Baltimore, Md.; Tredegar Iron Works, Richmond, Va.; Portland Company, Portland, Me.; Palm & Robertson, St. Louis, Mo.; Menominee Locomotive Works, Milwaukee, Wis.; Ballardvale Locomotive Works, Ballardvale, Mass.; Springfield Locomotive & Car Works, Springfield, Mass.; Corliss & Nightingale, Providence, R. I.; Mt. Savage Locomotive Works, Mt. Savage, Md.; Dawson & Bailey, Connellsville, Pa.

A young fellow just from college in describing a new locomotive for a paper he represented said that the weight, as given by the superintendent of motive power, was 134,000 pounds in working order, but he then intimated that 200 pounds might be added, as the engineer informed him that they were carrying 200 pounds of steam. The engineer was a practical joker.

Two Corrections.

Following the suggestions in the article on "Locomotive Building in the United States," in your February issue, that any corrections will be appreciated, I beg to say, from personal observation, that the so-called "mud digger" engines of Ross Winans did not have "a vertical boiler in the center," as stated on page 61, their boilers being of the ordinary horizontal locomotive type. These engines were geared and presented the peculiar effect of main rods and coupling rods moving in opposite directions. They were the "Buffalo," No. 35; "Baltimore," No. 36; "Cumberland," No. 37; "Elk," No. 41; "Tuscarora," No. 45, and "Allegheny," No. 47, of the Baltimore & Ohio Railroad.

Again, the Winans "camel" engines did not have "a wide firebox overhung the back drivers," as stated, the front portions of their fireboxes being set *between* the back drivers and not over them. The term "wide firebox" is generally and properly taken to mean a firebox which is as wide as, or wider than, the distance between the outer faces of the driving wheels, and which must consequently be placed *above* them. J. Snowden Bell.

[I am pleased to have Mr. Bell's corrections, and hope others will follow suit. I do not see, however, why a wide firebox *must* be placed over the wheels, although it is usually more convenient to do so. Winans' firebox could have been wider than wheels and still retain its position behind the wheels.—F. H. C.]

More Perpetual Motion.

A Toledo man claims to have invented what he calls a trimounter, and which we call a perpetual-motion humbug. The inventor of this so-called invention got hold of a gullible Associated Press reporter, who was induced to send out the following rot in his dispatches: "Take an ocean vessel, for instance. It can be propelled without coal, which means that there is no use for bunkers, boilers and smokestacks. Street cars can be run without the bothersome trolley and can be operated more easily than to-day. The trimounter can also be employed to heat dwellings and factory and office buildings, instead of the methods employed now. It will save millions and millions of dollars to steamboat companies. There is not a spark of doubt in my mind that my invention will not do all I claim for it, and I regard it as the wonder of the age."

We never knew of a visionary working on a device to overcome the immutable laws of Nature who entertained a spark of doubt that he would succeed. It is the old story of a man scheming to lift himself by his own boot straps.

Against the Double Cab.

The organized railway men of Ohio recently presented to the legislature bills regarding the operation of trains. Both were aimed at the practice of dividing its directing power. The first, introduced by Representative Castle, of Crawford County, will do away with the double cab engines now in use. It prohibits the separation of the engineer and fireman on the broad ground that someone should be ready at all times to control the engine. The other bill, introduced by Mr. Pollock, of Stark County, prohibits the use of pushing engines on trains unless the front engine is disabled. The absence of communication between engine drivers where an engine is placed behind is said to be the frequent cause of accident and consequent loss of life.

Both these measures are in the interest of safety, but we do not believe either of them will prove more influential than the railroad lobby. The double cab engine has come to stay. Agitation against the danger of separating the enginemen ought to be directed to having a third man on the engine. That will appeal to a great many legislators as being reasonable. When trainmen ask to have the radical change made on the modern locomotive which taking away one of the cabs implies, rail-

road officials have no difficulty in proving to the satisfaction of the law makers that the demand is in opposition to progress. Railroad officials say that the legislators who favor abolishing the Mother Hubbard engines "are trying to make a strike." We do not know what that means, but suppose it to be something in the nature of "a shake down."

No. 5 of the New York Central Four Track Series is devoted to America's winter resorts. It is gotten up in the old folder form and has two large maps which show the whole of America, with the leading railroad connections made by the New York Central. The folder will be found a very useful reference for people who are looking for change of climate. The folder will be sent to any person on receipt of a two-cent stamp by Geo. H. Daniels, G. P. A., Grand Central Station, New York.

We have received from the McPherson Switch & Frog Company, Niagara Falls, N. Y., an illustrated catalogue of the switches, frogs and other track material made by the company. It also contains several pages of illustrations of track tools and a great deal of useful information for trackmen well arranged for reference. The catalogue is prepared in a form that makes it convenient for the pocket and contains blank pages for memoranda. It is a book that every section foreman and maintenance-of-way engineer ought to carry in his pocket. The McPherson Improved Safety Switch and Frog which are illustrated in the catalogue appear to have decided advantages over the ordinary types.

Foreign railway companies, outside of Great Britain, nearly all equip their locomotives with speed indicators, because there appears to be difficulty in training the engineers to tell how fast they are running without the aid of an indicator. An elaboration of the ordinary speed indicator has lately been introduced on some French railways which acts to apply the air brake, should a certain speed be exceeded. It is no doubt an ingenious invention, but railroad companies are fortunate who do not require to equip their engines with speed recorders for the guidance of their engineers.

Perhaps one of the greatest engineering achievements of its kind in America is the Great Northern Railroad tunnel through the Cascade mountains. It is 2½ miles long in a straight line, is lined throughout with concrete, and is 23 feet high by 16 feet wide. After nearly four years of continuous work, the two forces, working from opposite sides, met midway under a granite roof more than a mile thick. The cost of the tunnel was about $5,000,000.

The Education of Mechanics.

One of the prime reasons for failure on the part of men who have without assistance endeavored to advance themselves along any particular branch of study is, that few are willing to start at the bottom and work along well-defined lines. The tendency is to skim over the elementary lessons and jump at once to some point where the student would like to be. The result is that the beginner finds himself in "deep water" and probably gives up too soon, feeling that the subject is too much for his comprehension. As a matter of fact, had he been given only a limited amount of elementary study at one time, and been allowed to thoroughly digest it before proceeding, the road would have been comparatively easy. This is where the best correspondence schools have proved so beneficial to those deprived of the advantages of an education. Not so many years ago, when books were very expensive and papers few, it was quite a difficult thing for a poor man to advance himself even along the line of his occupation, and to change his business for some other which he felt he was more fitted for was almost impossible. The work in which he accidentally found himself was usually that which he was forced to follow, for no other than the simple, though it might be said tragic, reason that he had not the money to attend some college. To-day, however, a man with a very limited capital, coupled with a desire to be something more than he is, can, without leaving his work, join the ranks of a correspondence school and master almost any branch which is worthy of study.

The Universal Car Bearing Company, of Chicago, have lately received the following orders: Six hundred cars, Wheeling & Lake Erie Railroad; 500 cars, Wabash Railroad; 300 cars, Great Northern Railway; 500 cars, American Car & Foundry Company; 60 engines, Great Northern Railway.

The boiler of a freight locomotive on the Lake Erie & Western Railroad exploded while the engine was standing on a siding near St. Mary's. Fireman Floyd Brown, of Lima, was killed outright and Engineer Edward Casey, of Fremont, scalded so badly that he died a few hours later. A number of cars were wrecked. A defective crown sheet is supposed to have been the cause of the explosion.

The latest addition to our book list is "Examination Questions and Answers on the Handling of Locomotives," by W. O. Thompson, the well-known secretary of the Traveling Engineers' Association. Needless to say, this is a book that every engineer (as well as those who aspire to handle he throttle) needs to keep by him. It is handled exclusively by our book department, in two bindings, at 50 and 75 cents.

J. A. Fay & Egan Company, of Cincinnati, Ohio, the large manufacturers of standard wood-working machinery, have just opened a new branch office at 69 Chapin Block, Buffalo, N. Y., in charge of Mr. B. E. Crafts, who will at once enter into active business operations to further the interests of the company. Mr. Crafts has heretofore represented the firm as salesman for that territory, but the continually increasing business of the company necessitated this new move, which will better enable them to cater to the wants of the users of wood-working machinery.

The United States Metallic Packing Company are running their shops night and day trying to keep up with orders, but they are still in arrears on orders. They are making 1,500 sets of packing for new work every week and 6,500 parts for repairs.

INDEX TO ADVERTISEMENTS.

Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XV. | 174 Broadway, New York, April, 1902 | No. 4

The Four-Cylinder Compound Express Locomotive for the T. R. State Railways of Austria.

BY IAROSLAV HRDRA.

Before giving principal dimensions of this locomotive, a few words of the builder, who is perhaps unknown to our readers, will be interesting. This firm is called "Proni ceskomoravská továrna na stroje v Praze" (First bohemian-moravian machine-manufactory in Prague)—was founded 32 years ago (1870) and is situated near Prague. To-day this manufactory and its products is at the head of all the manufactories of Austria. It builds steam-engines, hoisting-engines, sizing-apparatus, all kinds of pumps, electric cranes, sugar-machinery, boilers, bridges and many others—the latest product being locomotives.

The locomotive illustrated is of the American type (Atlantic), and has been introduced on the I. R. State Railways of Austria. The locomotive—called Series 108—was constructed by the above firm from the designs of Mr. Charles Gölsdorf, and is for the fast passenger service between Prague and Vienna. It was designed to maintain a speed of 563 miles per hour and to keep the weight down to 17,500 pounds in each driver.

The locomotive Series 108 is a four-cylinder compound engine with Gölsdorf starting gear, and the main-rods of both high-pressure and low-pressure cylinders drive the same axle. The valve gear of the external cylinders is of the Heusinger type, the inside valves being actuated from a rocking shaft which is driven from the cross-head of the low-pressure valve stem. The crank pins on each side are located opposite each other, the left side leading. This makes a balanced engine. The locomotive was tried in Vienna on the West Railway and the highest speed obtained was 87½ miles per hour with a train consisting of one baggage car and one saloon carriage. Pulling a train of 230 tons weight on a gradient of 1 to 100 a speed of 46½ miles was maintained. The engine started very easily and its running was exceedingly quiet. Following are the leading dimensions of this locomotive which, being recent Austrian practice, are given in more detail than usual.

Boiler:

Working pressure.........214 lbs per sq. inch.
Outside diameter of first ring..........65 inches.
Thickness of plates in barrel...........$\frac{11}{16}$ inch.
Horizontal seams; butt joined in the welt strips inside and outside, sexuple riveted

Smoke-box:

Diameter inside.................. .....65 inches.
Length inside.........................55 "

Chimney (cast iron):

Smallest inside diameter...........16¾ inches
Diameter at the top ....19 "
Smokestack top above rail...............15 feet.

Tubes (Martin-Flusseisen):

Member.......................................329
Diameter outside... . ... 1¾ inch.
Length between tube plates.....13 feet. 1 "

Heating surface:

Fire-box...........................179 sq. feet.
Tubes..............................2,270 " "
Total..............................2,449 " "

Grate area...............................38 " "

Safety valves:

Two 3½ inch pop safety valves—system, Coale.

Injectors:

Two re-starting injectors (cl. T. No. 9) —system, Friedmann of Vienna.

Frame:

Distance between main frames, front end. 47 inches.
Distance between main frames hind end..44½ "
Thickness of main frames.. .. .. 1 inch.

Cylinders:

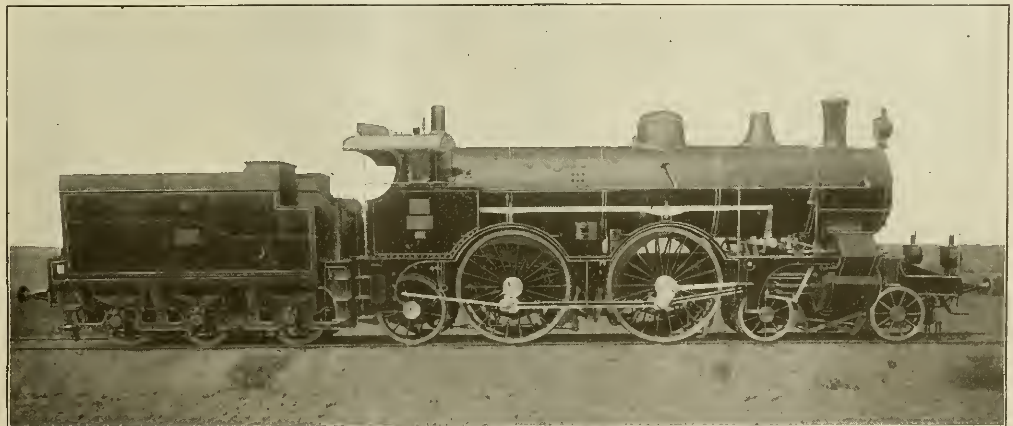
Number of cylinders 4
Diameter of high pressure cylinders, 13¾ inches; Diameter of low pressure cylinders, 23⅝ inches — ratio of volumes 2.93.
Stroke of piston......................26¾ inches.
Ratio of receiver-volume to the volume of low pressure cylinder..11

Steam passages:

Steam ports ....$1\frac{9}{16}$ x $11\frac{13}{16}$ inches.
High pressure cylinder, exhaust ports..3 x $11\frac{13}{16}$ "
Steam ports......................$1\frac{9}{16}$ x 19 "
Low pressure cylinder, exhaust ports..3 x 19 "
Size of bridges........................ 1⅜ inch.

Valve motion (Heusinger):

Slide valves not balanced.
Outside lap of slide valves............ 1¼ inch.
High pressure cylinders, inside clearance..$\frac{5}{16}$ "
Low pressure cylinders, outside lap of slide valves..1¼ "



FOUR CYLINDER COMPOUND ON THE AUSTRIAN STATE RAILWAY.

Low pressure cylinder inside clearance	$\frac{1}{8}$	"
Greatest travel of slide valves	$7\frac{7}{8}$	inches.

Truck axles (crucible steel :

Diameter at wheel seat	$7\frac{5}{16}$	inches.
" " bearings	$7\frac{1}{16}$	"
" " middle	$6\frac{13}{16}$	"
Length of wheel seat	$6\frac{5}{16}$	"
" " bearing-journals	$10\frac{5}{8}$	"
Distance between centers of bearings	$42\frac{1}{2}$	"

Driving axle (crank axle), 1% nickel-steel.

Diameter at wheel seat	$8\frac{1}{8}$	inches.
" " bearings	$7\frac{7}{8}$	"
" of crank-pin journal	$8\frac{1}{2}$	"
Length of wheel seat	$7\frac{1}{2}$	"
" " bearing-journals	$10\frac{5}{8}$	"
" " crank-pin journal	$3\frac{15}{16}$	"
Distance between centers of bearings	$45\frac{1}{4}$	"

Coupling axle (crucible steel):

Diameter at wheel seat	$8\frac{1}{8}$	inches.
" " bearings	$7\frac{7}{8}$	"
" " middle	$7\frac{1}{2}$	"
Length of wheel seat	$7\frac{1}{2}$	"
" " bearing-journals	$10\frac{5}{8}$	"

Railroads Not Responsible for Killing Geese.

It has been the practice of the courts to hold railroad companies responsible for the killing of nearly all kinds of animals that strayed upon unfenced track, but a case with a different ending has come up lately in Tennessee, where a farmer sued a railroad company for the killing of three geese valued at $1.50. The court drew the line on the geese and decided that the railroad company was not liable for the killing of that sort of animal. The following are a few of the salient points of the decision:

"We think there is no evidence of recklessness or common-law negligence shown in this case, and the only question is whether a goose is an animal or obstruction in the sense of the statute, section 1574, sub-section 4, Shannon's compilation, which requires the alarm whistle to be sounded and brakes put down and every possible means employed to stop the train and prevent an accident when an animal or obstruction appears on the track. It is evident this provision is designed not only to protect animals on the track, but also the passengers and employés upon the train from accidents and injury. It would not seem that a goose was such an obstruction as would cause the derailment of a train if run over.

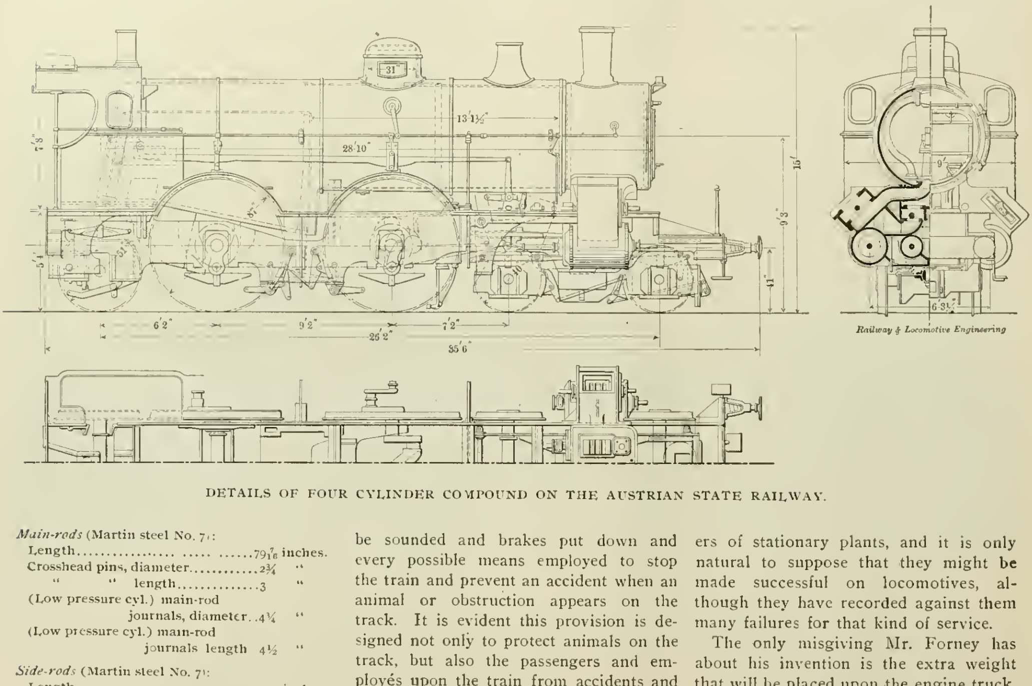
"It is true, a goose has animal life and in the broadest sense is an animal, but we think that the statute does not require the stopping of trains to prevent running over birds such as geese, chickens, ducks, pigeons, canaries and other birds that may be kept for pleasure or profit. Birds have wings to move them quickly from places of danger, and it is presumed they will use them; a violent presumption, perhaps, in case of a goose—an animal which appears to be loath to stoop from his dignity to escape a passing train.

"But the line must be drawn somewhere, and we are of the opinion that the goose is the proper bird to draw it at."

M. N. Forney's Feed Water Heater.

The veteran railroad mechanical engineer, M. N. Forney, has always been an advocate of using some of the waste heat that passes out through the smoke stack of a locomotive to heat the feed water. He has been long working upon the designing of a device for this purpose, and he thinks it is about ready for application. He does not think that it will save 50 per cent. of the fuel used, but he thinks it will save enough to induce railroad officials to apply it to their locomotives. Heat economizers are a decided success in connection with the boilers of stationary plants, and it is only natural to suppose that they might be made successful on locomotives, although they have recorded against them many failures for that kind of service.

The only misgiving Mr. Forney has about his invention is the extra weight that will be placed upon the engine truck.



DETAILS OF FOUR CYLINDER COMPOUND ON THE AUSTRIAN STATE RAILWAY.

Main-rods (Martin steel No. 7):

Length	$79\frac{7}{16}$	inches.
Crosshead pins, diameter	$2\frac{3}{4}$	"
" " length	3	"
(Low pressure cyl.) main-rod journals, diameter	$4\frac{1}{4}$	"
(Low pressure cyl.) main-rod journals length	$4\frac{1}{2}$	"

Side-rods (Martin steel No. 7):

Length	110	inches
Crank-pins, diameter	$4\frac{3}{4}$	"
" length	$3\frac{3}{4}$	"

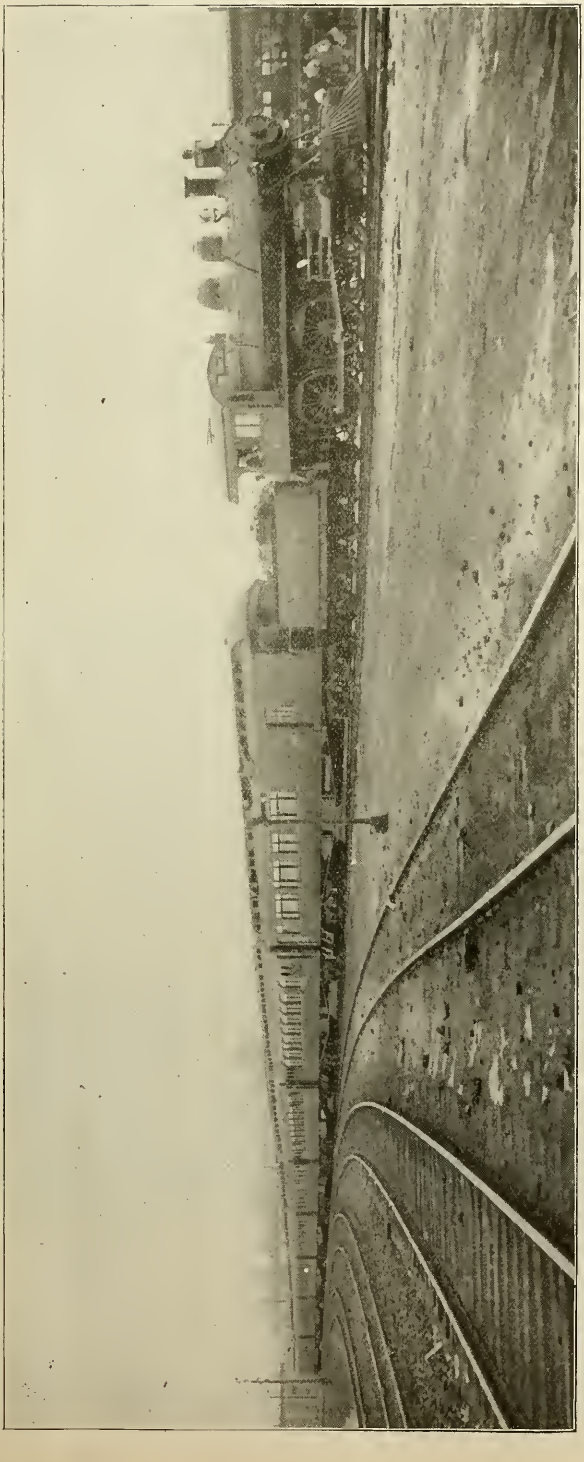
Starting gear (Gölsdorf system).

Brake:
Automatic vacuum brake—system. Hardy of Vienna.

Sand-box:
Steam sand-box on drivers and truck-wheels—system. Holt & Gresham.

Weight empty	134,000	lbs.
" in running order	150,000	"
" on truck	58,600	"
" " first pair of drivers	31,900	"
" " second pair of drivers	31,900	"
" " trailing wheels	27,600	"

The last report of the State Railroad Commissioners says: "The evils of overcapitalization, the building of roads with no good reason for existence, and the practice of paying dividends at the expense of proper maintenance are to-day apparent in impaired properties, lack of proper car equipment, insufficient power plants and poor track and road bed." There is little reason to doubt, the report says, that in the coming year the standard of equipment and service will be decidedly improved.



Specially Photographed for RAILWAY AND LOCOMOTIVE ENGINEERING By Mr. F. W. Blauvelt.

PENNSYLVANIA SPECIAL TRAIN FOR THE USE OF H. R. H. PRINCE HENRY OF PRUSSIA DURING HIS RECENT VISIT IN THIS COUNTRY.

Train for H. R. H. Prince Henry of Prussia.

When it was decided that His Royal Highness, Prince Henry of Prussia, should make a short tour through the United States, Assistant Secretary of State Hill at once called into consultation the officers of the Pennsylvania Railroad Company and sought their advice concerning the transportation features and the itinerary. The Secretary and the other officers composing the Reception Committee stated that by reason of its resources, excellent management, and completeness of its tourist system they considered the Pennsylvania the safest and best transportation line in the land to which they could entrust all matters connected with the movement of their distinguished guest. So a formal contact for the transportation of the Prince and his suite for the entire tour was entered into between the representatives of the Government and the railroad company. The selection of the train was left to the railroad. The outlines of the itinerary prepared in Washington were developed and worked out in detail by the Pennsylvania Railroad officials. Every stop of the train in its course of nearly five thousand miles, every detail of its movement, were arranged by correspondence and wire with connecting lines a fortnight in advance of the starting date. The schedule was adapted to the peculiar characteristics of each connecting line, and the scope of the tour was measured by every available hour of the time at the Prince's disposal. Every general manager of every road used knew the exact time he would receive the train and the hours at which he was expected to deliver it at each point on his line. Nothing was left to chance, but everything relating to the movement of the train was as absolute and as well understood as if it were a regularly scheduled train in every-day service.

The selection of officers and men, of which twenty-four composed the crew, was made with a special view to their fitness and experience. The crew included not only the usual attendants of a first class limited train, but special stenographers, a special baggage agent and competent telegraph operators.

The train which was composed of the Pennsylvania's Class "L" passenger locomotives, number 850 and 8 cars, made up in the following order, commencing with the engine: Pullman composite baggage and smoking car "Utopia," two Pullman sleeping cars, the "Biscay," and "Garonne," for the attendants; the Pullman dining car "Willard," three Pullman compartment cars, the "Iowa," "Indiana" and "Ohio," and the Pullman private car, the "Columbia," occupied by the Prince.

The dining car "Willard," is the latest production of the skill of the Pullman

Company. It is attractively finished in mahogany, with high pitched roof, and presents upon entrance through wide vestibules the appearance of a small but cosy café. It is furnished with ten tables and ordinary café chairs.

The compartment cars "Iowa," "Indiana" and "Ohio," are all of the same pattern, though finished in different schemes of decoration. Even the compartments differ in their stye of finish between mahogany, maple, English oak and vermilion. There are ten staterooms in each car, all on the same side of the car, with a wide passage on the opposite side from end to end of the car. Every stateroom contains a double berth. The officers of the Prince's suite and the President's delegates were quartered in these compartments.

The "Columbia" was occupied by Prince Henry, Admiral Evans, Herr von Holleben, the German Ambassador, and Persönlicher Adjutant Capitän-lieutenant Schmidt von Schwind.

The "Columbia" is the handsomest and best appointed private car ever constructed by the Pullman Company. It was frequently used by President McKinley in his longer trips, and it came to the use of the Prince fresh from the shops. The car is seventy feet long and contains five private rooms in one section. Two of the private rooms are large, and are furnished with brass bedsteads, chests of drawers, wardrobes and large mirrors.

There is also space for steamer trunks, and a separate toilet compartment communicating with each room. The private rooms are finished in mahogany, maple and koko. The observation room which is also the dining room, is sixteen feet long, finished in vermilion and contains an extension table and two cabinets. Wide windows and a door enclose the rear end, which is a wide observation platform enclosed by bronze railings. The Prince received from this platform at points where the stop was too short to admit of his leaving the train.

The Prince took his meals in the "Columbia" with such guests as it was his pleasure to invite. When the train passed over the Allegheny Mountains he rode on the engine, which experience together with the scenery spread before him he enjoyed very much.

The illustration of the train shown here was made from a photograph taken by Mr. F. W. Blauvelt, near Jersey City. This was obtained through the courtesy of Mr. F. L. Sheppard, General Supt., and Mr. C. J. McConaughy, Asst. Pass. Train Master, at Jersey City, who had the train set in position for the purpose. Railroad men will appreciate what this means, to shift cars at a busy terminal. The interior views were made from photographs given to us by the passenger department.

Large vs. Small Locomotives.

BY F. P. ROESCH.

I propose making a partial analysis of the late comparative tests on the Illinois Central R. R.

In the recent extended road tests to determine the comparative efficiency of various types of locomotives on the Illinois Central Railroad, reports of which have been published in the current engineering press, I find a few facts which at first glance seem rather strange, not to say startling; and in probing deeper into them I find them still more surprising.

The tests were made with four different types of engines, viz.

Eng. No.	Cyl. Dia.	Cyl. Stroke	Drivers Diameter	Kind of Eng.	Working pressure
35	20"	28"	63"	10 wheel	180 lbs.
489	19"	26"	57"	Mogul	165 "
639	23"	30"	57"	Consolidation	210 "
640	23"	30"	57"	12 wheel	210 "

Each engine made 10,000 miles, the primary object being to find which type of locomotive would be the most economical—everything taken into consideration.

In analyzing the report, I will simply consider two of the locomotives tested in order to show that the result of the test leaves things still somewhat in doubt. The test shows that Engine No. 35, with 102.5 per cent. of calculated rating, was able to maintain an average speed of 20.24 miles per hour, while Engine No. 639, with only 84.3 per cent. of rating, made but 17.71 miles per hour.

On the face of things, this does not look so bad, but let us investigate a little. By the usual formula $\frac{d^2 \times S \times P}{D} = T$ and using 80 per cent. of the boiler pressure as the mean, I find the tractive power of Engine No. 35 to be

$$\frac{20^2 \times 28 \times 144}{63} = 25{,}600 \text{ pounds,}$$

and using the same formula, I find the tractive power of Engine No. 639 to be

$$\frac{23^2 \times 30 \times 168}{57} = 46{,}770 \text{ pounds.}$$

The total weight of engine and tender of Engine No. 35 is stated as 259,200 pounds or 129 tons, and Engine No. 639 as 308,400 pounds or 154 tons.

I will assume that the figures as given mean ready for service. It would make no material difference in the calculation, however, as the capacity of both tenders is practically the same. The hauling capacity of Engine No. 35 over the ruling grades on the division where test was made is given as 1,050 tons, while Engine No. 639 is rated at 1,800 tons.

Now if $H = \frac{T}{R} - W$ in which

H = Hauling capacity in tons
T = Tractive power
R = Resistance
W = Weight of engine and tender in tons; then $\frac{T}{H + W} = R$.

We have then the factor of resistance as applied to Engine No. 35 to be

$$\frac{25{,}600}{1{,}050 + 129} = 21.7 \text{ pounds per ton.}$$

The factor of resistance per ton over the same grade at the same speed is supposed to be constant. This being the case, to determine the hauling capacity of Engine No. 639 we should use the same factor as used for Engine No. 35; then, as $H = \frac{T}{R} - W$, we find that the rating for Engine No. 639 should be $\frac{46{,}770}{21.7} - 154 = 1{,}996$ tons, instead of 1,800 tons.

Referring again to the performance sheet, I find that the average tonnage in test trains for Engine No. 639 was 1,517 tons, or 84.3 per cent. of stated rating, but by using the same factor of resistance to determine the theoretical rating, as used for Engine No. 35, I find that Engine No. 639 hauled only 76 per cent. of her correct rating.

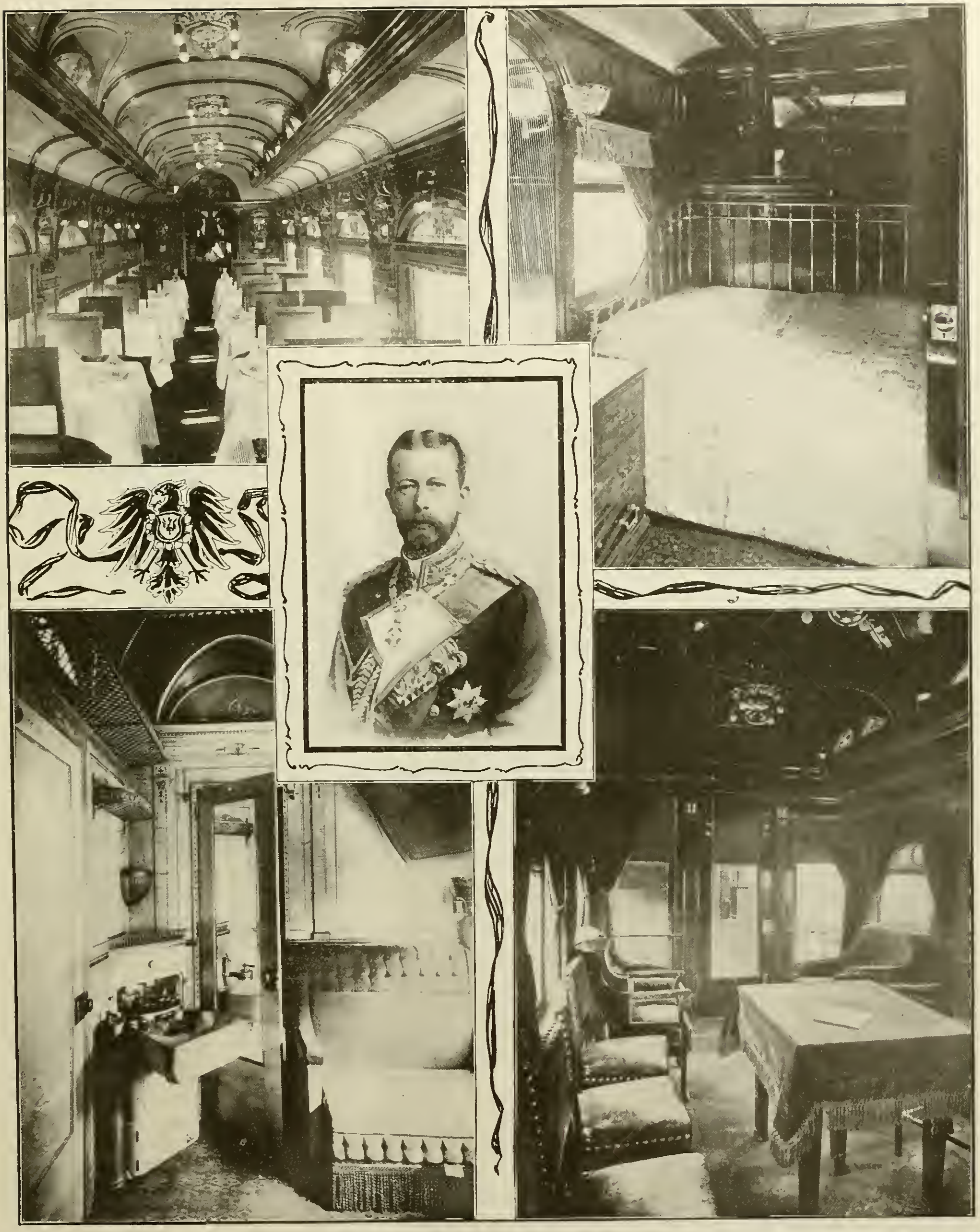
The question now arises: Why could Engine No. 35 with 2.5 per cent. above her theoretical rating maintain a speed of 20.24 miles per hour, while Engine No. 639, although under-rated 24 per cent., made but 17.71 miles per hour?

There is a reason for this. Perhaps some of our readers will figure it out. If not, I will try to explain it in some future issue of RAILWAY AND LOCOMOTIVE ENGINEERING. There are several other features connected with this test, that might cause one to pause and consider well before ordering any more locomotives of the 639—640 type for this particular division.

Old Cars and Hedge Rows.

Railroads report increased and steady retirement of the old form of wooden gondola and hopper bottom coal cars as the 50-ton steel cars grow more numerous. The pulling and buffing strain on the wooden cars when in trains containing steel cars are so severe that the wooden cars are unable to hold up under it, and they gravitate to the scrap heap.

The pretty little hedge rows planted by the Pennsylvania on the outer borders of the right of way of its main line between Philadelphia and New York have received much attention and caused considerable favorable comment by observing passengers. As an adorning feature these hedge rows along with the green-sodded side banks of the cuts have been pronounced a success. A further value, however, and one of practical utility, has forcibly demonstrated itself in the recent snow storm and blizzard. These hedge rows have proved excellent snow fences, and trapped huge banks of the "beautiful" under their lee, thus preventing the cuts from filling up.



H. R. H. PRINCE HENRY OF PRUSSIA AND INTERIOR OF HIS PRIVATE CAR AND TRAIN.

European Railway Jottings.

BY CHARLES ROUS-MARTEN.

A third British railway has gone in for the six-coupled ten-wheeler type of express locomotive with outside cylinders. And, strangely enough, this latest in the field is the line which has always been pre-eminently the home of the inside cylinder and the single-wheeler, viz., the Great Western.

It is only of late years that the best Great Western expresses have been regularly run by coupled engines—even four-coupled. But the idea of a *six*-coupled express engine might have been expected to be as repugnant to the Great Western mind as outside cylinders, which have never appeared on that line save in some very exceptional circumstances. For on the Great Western, outside cylinders have always been regarded as a wild and wicked freak, not to be taken seriously by sober-minded engineers. But Mr. William Dean, the able Chief Mechanical

Engineer, declines to be "tied and bound" with ancient traditions, and he has now broken loose with a vengeance.

NEW BRITISH OUTSIDE CYLINDER ENGINES.

According to the information which has reached me so far, the new Great Western locomotive has been specially designed for working heavy expresses over the severe grades of that part of the main line which runs through Devonshire and Cornwall, viz., from Exeter to Plymouth, Truro, Falmouth and Penzance. This is one of the hardest lines in the whole world on which fast expresses run. It has an almost continuous succession of steep grades up and down alternately, as it crosses the numerous Devon and Cornish valleys, these grades being usually at about 1 in 50 to 1 in 60, *i. e.*, about 2 per cent.; but sometimes as steep as 1 in 41 and even 1 in 40. *i. e.*, 2.5 per cent. In the days of the 7 ft. gage the expresses over this length were worked by saddle-tanked locomotives with 66 inch wheels four-coupled. After the conversion to the 4 feet 8½ inch gage the express work was long done by engines with only 60 inch coupled wheels, the smallest size known in Britain for express duty, and originally these were tank-engines, but in the end all were converted to the tender type, the Board of Trade having condemned the use of tank engines on express trains after two serious accidents had occured.

Then, seven or eight years ago, came Mr. Dean's "Duke of Cornwall" bogie class, with 68 inch coupled wheels and cylinders 18 x 26 which have since been developed into the domeless "Camels," with identical wheels and cylinders but with far larger boilers and Belpaire fireboxes. These have done excellent work, but have still required assistant engines over the severest grades, when their loads exceeded 200 tons on trains having an average inclusive schedule speed of over 40 miles an hour. It is to meet this difficulty and to avoid the use of pilot-engines that Mr. Dean has just brought out his newest type.

This new engine which bears the number "100" has 80-inch driving-wheels, like the locomotives of the "Atbara" and "Badminton" classes, but has an additional pair, being of the six-coupled type, with leading four-wheeled bogie. The cylinders, like those of the "camel" and "Atbara" classes, are only 18 inch in diameter, but the stroke has been lengthened to no less than 30 inches. This length of piston stroke is not unprecedented in Britain, but does not at present exist save in the case of the new locomotive. A batch of express engines which came into the possession of the North Eastern Railway through one of its numerous absorptions, had the same length of piston stroke, 30 inches, with 17 inch cylinders placed outside, and 84 inch coupled wheels. They were designed by Mr. Bouch and are said to have done good work. But on their falling into the hands of the North Eastern Railway, they were speedily converted by Mr. E. Fletcher, the Chief Mechanical Engineer of the day, into his own standard type, which had inside cylinders 17 x 24.

Mr. Wilson Worsdell, the present Chief Mechanical Engineer of the North Eastern Railway, who has been the pioneer in this country in the introduction of the six-coupled ten-wheeler type for express service, gave his engine cylinders 20 x 26, their driving wheels being 73 inches in the earlier type and 80 inches in the later. Mr. Peter Drummond, Chief Mechanical Engineer of the Highland Line, was the next to adopt the type, using 19½ x 26 inch cylinders with 69 inch wheels. Mr. Dean, as I have said, uses 18 x 30 cylinders and 68 inch wheels. Here is a curious diversity of practice.

But just as Mr. P. Drummond's boiler, with its 2,050 square feet of heating surface, exceeded Mr. Worsdell's with 1,750, so does Mr. Dean's boiler exceed Mr. Drummond's. The new Great Western boiler is 14 feet 8 inches in length and 5 feet in diameter. It has no less than 2,400 square feet of heating surface, with a Belpaire firebox 9 feet in length; the grate area is 28 square feet. The boiler is constructed for a steam pressure of 200 pounds per square inch, but I understand that 180 pounds will ordinarily be used.

The height to chimney top is 13 feet 2 inches above rail-level, and the extreme breadth over the outside-cylinder lagging is 8 feet 11 inches, these being the limits permitted by the Great Western loadgage. The boiler center stands 8 feet 6 inches above the level of the rails. The new engine has piston-valves 6½ inches in diameter, worked by the Stephenson link motion and a rocking shaft. The bogie-wheels are 3 feet 2 inches in diameter, and the tender carries 5 tons of work and 4,000 gallons of water; it also has the pick-up scoop for taking in water at speed from the track tanks. The rigid wheel base of the engine is 14 feet 9 inches, and the total wheel-base of engine and tender is 53½ feet. The engine alone weighs 69 tons (British), tender, 36 tons; total weight of engine and tender, 105 tons.

A highly diverting account of the engine is given by some of the daily papers, especially the local provincial journals, published in the vicinity of Swindon. One of these often mentions that the engine has a "Benpairi" firebox and "rockshafts" and "6 feet 8½ inch" coupled wheels, and adds casually that it "has a duplicate set of driving wheels 5 feet 8 inches in diameter, which will enable it to be used on heavy goods trains." This is truly delicious! The notion of an engine with alternative six-coupled drivers, one set 80½ inches, the other 68 inches in diameter, which can be put on or taken off at will, thus enabling the locomotive to be optionally used for fast express passenger work or heavy goods duty, is delightfully characteristic of the way English newspapers view railway matters, and of the intelligence with which they comment on matters of locomotive practice.

THE REVOLUTIONARY VALVE GEAR.

A tremendous trumpet blast has been blown in *The Times* and other papers in publication of the amazing merit of a new valve gear, designed by Mr. J. T. Marshall, a Leeds engineer, and in course of experimental trial on the Great Northern Railway. Without indorsing or disputing the large claims made on behalf of the new gear on the score of unprecedented efficiency—which I am not in a position to do pending adequate personal tests of its work—I may say that I have received from capable persons whose good faith and credibility are entirely beyond question, accounts of the new apparatus, the outcome of their own private tests, which certainly do appear to bear out all that is alleged on the part of its inventor. If this can be sustained in actual practice, a new era will have been established in locomotive efficiency and economy.

Mr. Marshall in his specifications, states that he provides two main admission valves and two exhaust valves, all situated in parallel cylindrical chambers, which may be provided either in the cylinder body or, as is preferred, in the cylinder covers. Each main admission valve is arc-shaped in cross section, having two concentric surfaces which communicate with each other by means of a suitable longitudinal port, or more than one, and in some cases intermediate chambers, and formed within the body of the valve. The outer of these two concentric surfaces will form the valve-face bearing against the surface of the cylindrical chamber in which it is located. There may be two intermediate chambers, each communicating with the valve-face by means of a longitudinal port, or more than one port, and similarly with the inner surface. He works the valves by means of an ingenious method of gearing, which he claims will give the promptest possible admission of steam to the cylinders followed by the quickest and completest exhaust. It is contended that by this means on the one hand, the full force inherent in the admitted steam is immediately utilized up to its entire power value, and on the other, that, through the ease and swiftness of exhaust, the drawback of back-pressure is diminished in so material a degree that its obstructive effect is minimized.

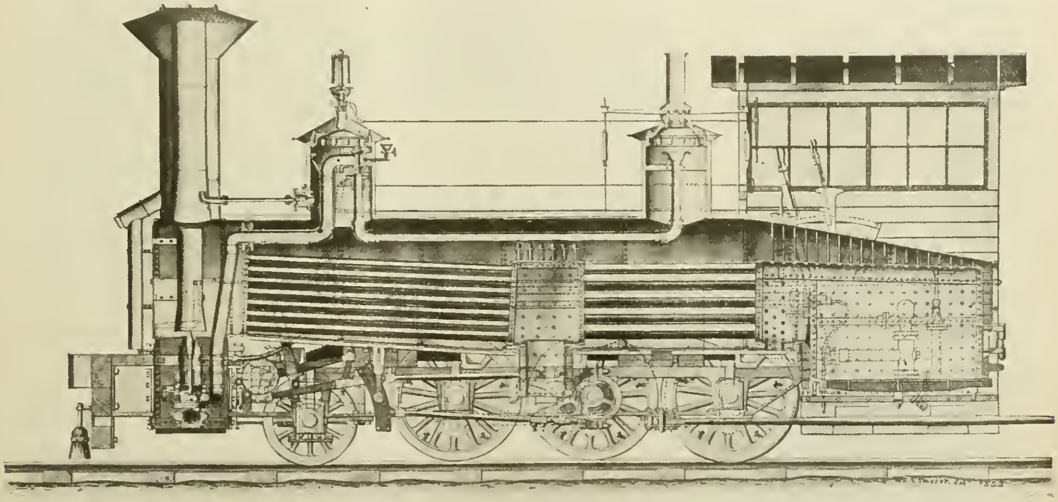
The main advantages claimed to accrue from the use of the new valve gear are stated thus: 1. That a large increment of work can be obtained out of an engine without increased consumption of fuel; 2. Or a given amount of work can

be got from the engine with largely reduced fuel consumption; 3. That a lower steam-pressure can be employed under the new system without loss of power as compared with a higher pressure under the old system, and thus the enhanced wear and tear involved in the use of the higher pressure is averted, and consequently a large saving effected; 4. That a given amount of work can be performed on any railway with far fewer engines than would be required under the old system; 5. That many old engines, which would otherwise be condemned as lacking the strength needful for efficiently performing modern duty, can, with the aid of this valve-gear, be rendered practically as efficient as modern engines nominally possessing greater power; and 6. That hence will be derived large benefits in the direction of economy, because less fuel will be used, therefore the coal bills will go down; fewer engines will be needed, therefore the wage bill will be decreased; larger loads can be taken, therefore fewer trains will have to be run; the road will, therefore, be less blocked, and so widening will not be so imperative.

Such is the case as put forward on behalf of the inventor. An old coal-engine nearly worn out, was fitted experimentally with Mr. Marshall's gear, and gave results so favorable that other engines are now being fitted, and I expect to witness some special trials shortly. Meanwhile it is asserted that the small twenty-year-old six-coupled engine fitted with the valve gear pulled a load as heavy as that taken by the newest eight-coupled giant. This is a very surprising statement, indeed; altogether the accounts of the new gear's results read so much like fairy tales that only the unquestionable high personal character of the narrators, who are individually known to me, leads me to attach weight to the figures given. As it is, I am watching with keen interest for further results and developments. Certainly the invention does seem to have established its claim, at least to respectful consideration and careful trial.

Some Details of Milholland's "Juniata" of the Reading Road.

The sectional view of Milholland's Juniata, built in 1855, shown herewith will interest any railway man who likes to compare locomotive construction. The boiler attracts attention at once on account of the central combustion chamber with the two sets of flues. This is practically the same as the boiler of Webb's "Greater Britain," on the London & North Western road in England. In both cases the scheme was abandoned.



LONGITUDINAL SECTION OF JAMES MILHOLLAND'S ANTHRACITE COAL BURNER, JUNIATA, 1855.

The valve motion was a stationary link and shifting block with round eccentric rods and fastened to eccentric straps in a rather peculiar manner.

The variable exhaust was the old cone plug, which was raised or lowered by connection shown. The blower would paralyze those who insist that the jet must be central in the stack, yet it worked—whether as economically as in the other case remains for our friends at Purdue to determine.

There is a double-seated throttle valve with its oil pipe and cup running outside, and by-pipe runs to both domes. The pipe in front of arch was the outlet for cinders that found lodgment in the space between the inner and outer stack.

One other interesting feature, which was also found in Winans' "camels," is the drawbar between engine and tender. This is the round bar, large in the center, which extends from its connection between the back and middle drivers, through the ash-pan. Rather a long drawbar, but it never gave much trouble that we know of.

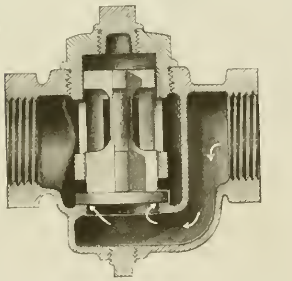
Lignite and Peat Briquettes in Germany

Consul Frank H. Mason, of Berlin, reports that the unprecedented scarcity and high cost of fuel last year and the unrelenting policy of the coal-producing syndicates in restricting their output to maintain high prices since the stress of demand has subsided, have combined to stimulate experiments and inventions which have for their purpose the better utilization of the vast deposits of peat and lignite with which Germany is endowed. It is stated upon official authority that the turf or peat beds of the Empire cover an area of 4,942,000 acres, and it has been deemed a reproach to German science that with such a wealth of material, the people should suffer for want of fuel.

Already during the past dozen years, great progress has been made in the manufacture and use of briquettes from brown coal or lignite, held together by a matrix of bitumen, either developed in the material itself by heating or added as a by-product of gas and coke manufacture. These briquettes sell in Berlin for from $2 to $2.75 per thousand, are clean to handle, make no smoke, kindle readily, yield a quick, though somewhat evanescent, flame, and are the standard domestic fuel of the poorer and middle classes in most German cities. But the supply of brown coal is limited and its area restricted in comparison with that of peat, which has heretofore played an insignificant role in the fuel supply of Germany.

This has been because of its large percentage of impurities, especially water, which in the humid climate of North Germany was difficult to eliminate, and which with the best preparation held the caloric value of weather-dried peat below the limit of availability for manufacturing purposes or even domestic fuel. The problem has been to devise a new and inexpensive process by which peat can be deprived of its excess of water, and, without admixture of bituminous or other coal, converted into briquettes of sufficient heating power to replace those made from other and more costly materials. Numerous processes more or less successful have been perfected and tested on an industrial scale, until finally one invented by Engineer Stauber is announced, which has the indorsement of the Royal Chemical Testing Station, at Berlin.

According to the published report of this institution, the briquettes made from turf by the Stauber method contain 45.14 per cent. fixed carbon, 4.54 per cent. hydrogen, 29.34 per cent. oxygen and 9.09 per cent. ash, and have a thermal value of 3,806 calories. This is fully up to the standard of brown coal, which latter has the defect of containing from 1.04 to 2.64 per cent. of sulphur, whereas the new turf briquettes are wholly free from that impurity, and are therefore adapted to a number of uses for which charcoal is now employed. German brown coal of average quality contains as it comes from the mine 60 to 65 per cent. of water, and the secret of successful and economical briquette manufacture from that material



GREENWOOD BOILER CHECK VALVE.

is to reduce the proportion of water to about 12 per cent., by the application of just sufficient heat to melt the bitumen which it contains and soften the whole mass to a consistency at which it presses readily into briquettes or blocks, which on cooling harden and become solid and clean to handle.

The Stauber process for working peat consists, so far as has been thus far revealed, of a series of specially contrived machines by which the crude turf is pulverized, fibers, roots and other impurities eliminated, the water removed by compression to the proper proportion, and the cleansed material reduced to a uniform consistency and pressed into molds by automatic machinery. To what extent heat is used, or whether coal tar is ever employed as a matrix to strengthen the structure of the briquettes, does not as yet appear. What is asserted on apparently trustworthy authority is that by the new process, peat will to a large extent replace lignite as a cheaper and far more abundant material for briquettes, and that briquettes so made will have sufficient thermal value not only for domestic heating, but for making steam and various minor processes of manufacture for which bituminous coal has heretofore been deemed indispensable. It is expected that the new process will not only serve to greatly relieve the scarcity of fuel in Germany, but eventually furnish a surplus for export to Switzerland and Italy.

A New Check Valve.

Something of a departure from the regulation form of check valve is shown in the accompanying cut. As will be seen, the cap and both guides are in one piece and entirely above the seat, leaving an absolutely free water passage. The seat being low in the check gives a long guide and effectually prevents cramping of valve. The valve has a flat seat, which of course requires less lift than a bevel seat for same opening. The plug at bottom allows all water to be drained off when there is danger of freezing.

The actual service given these valves during the past year on the Sandy River Railroad in Maine, indicates that they do not become coated and that they keep tight longer than many valves in use. It can easily be reground when necessary. The valves are being made by the inventor, Mr. E. Greenwood, Phillips, Me.

Crank Pin Turner.

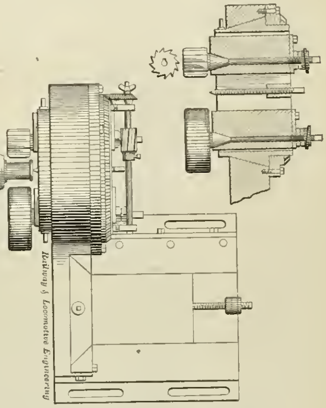
The machine illustrated herewith is the invention of Mr. Edward B. Sainsbury, of Caracas, Venezuela, and has some novel features. As will be seen, a milling cutter is used instead of a single-pointed tool, and there is a supporting roller on the opposite side of the crank pin. The machine is centered as usual and turns around the crank pin inside the main frame of the tool. The sectional view shows the coned bearing and the bevel gear which drives the revolving portion. In case the crank pin is hardened, an emery wheel can be substituted for the milling cutter and the pin trued up in this manner.

Mr. Sainsbury suggests that by substituting an annular cutter for the one shown, it can be used in cutting out old pins, and that this will require much less time than is necessary in long work, also that by mounting a drill chuck in place of the cutter the machine can be used for reaming and counterboring on any part of the frame. In this case, as in removing old crank pins, only the cutting spindle is reversed. These features should make it particularly adapted for railroad repair shops.

It will be noticed that the artist who drew the small bevel gears at the extreme left of the lower cut evidently knew more about drawing than about gears, and if the above mentioned artist can devise a way of making these gears work he will be entitled to a patent on a new mechanical movement.

The Supply Man Talks Branch Pipes and Other Things.

Turner was in the railway supply business—sold injectors and other things. Besides earning his salary in this manner he



CRANK PIN TURNING MACHINE.

served three or four old friends—master mechanics—in the capacity of mechanical adviser—told them about the new things their neighbors were doing, and which they were too much overworked to see for themselves. That suggests the fact that these "unwinged angels of commerce" are serving, without pay, many ambitious motive-power men in the capacity of mechanical and traveling engineers, air-brake experts, etc., filling the places of men that should have been provided the department long ago, but were instead withheld by a management that made economy a study by day—and then worked overtime at night, trying to figure a meeting point for both ends—without sawing by. Funny, isn't it, how men get economy and closeness mixed? The company that sent Turner out made an injector that worked, as most injectors do, when their diet is confined to liquids rather than such solids as coal, cinders, waste, etc., and as a result he had little to do in the expert line for his own company, giving him considerable time to devote, sort of missionary like, to his friends. Turner and this particular M. M. ran on the same pike years ago, belonged to the same division, so the supply man made himself at home in the smoky old office, located over the end of the

boiler shop, and not far from the flue rattler.

Turner often said he "liked to lay over" in this particular office—said it "kind of reconciled" him to a "coming hereafter"—the management on the Northern was afraid a too comfortable office would keep the boss out of the shop. After passing one of the "house" cigars to the M. M. and lighting one himself, the supply man threw his feet across the corner of the desk and said: "Tom, why don't you improve on those unsightly branch pipes you put up on those '700's' with that last batch of squirts I sent you? I rode up with Wilson on the '763'; he was pulling No. 4 this morning, and, say, the weather was anything but tropical. Wilson is struck on the squirts, but you should have heard him cuss the man that put up the frost pipes under the boiler checks. The globe valves were coupled to the checks with a 4-inch nipple, just long enough to make a pocket easily frozen; they were both solid when he took the engine at the depot—the left one split open—and when the fireman put the heater on the left side Wilson could not get near enough to oil 'round. No wonder your engineers have to go to Kelly's for their Hostetters. after trying all winter to make a torch compete with two ¼-inch pipes discharging steam into 18 below zero weather."

The M. M. relit his Clay, read a message the cub handed him and said: "What does your ambitious brain want to do for the Northern now—get me into a row with Carroll again by asking for material to make some new-fangled hobby out of? Your squirts seem to suit the boys, but those pipes are just as they came from the works ten years ago, and they are putting them out in the same way yet. Baldwins don't make snide engines either—at least we would be mighty glad to have some more of them, or any other old make. You have no idea how bad we want engines; it takes a year to get them—don't want to take orders, except for compounds. I notice, though, that those fellows over in India, China and Egypt get their orders filled in ninety days—get them at bed rock prices, too."

HIGH WATER MARK IN THE BALTIMORE & OHIO STATION AND TUNNEL IN PHILADELPHIA.

"That's the trouble with you fellows," said Turner; "you are afraid of those people up in Chicago; they tell you what you want and what you do not want, and when things do not pan out you are the one that carries the banner. They give you a shove by saying to the general manager, 'Our young friend is a nice fellow, but a little light'—in other words, they unload on you and you take your medicine. Well, in this case I have figured out a scheme to save your nerves; you can change over the old pipes, using no new material except some plain line checks. Perhaps you can get them at a bargain counter in a dry goods store, or you can make over the old boiler checks into globe valves and charge the work up against that car of the Old Man's that I noticed in the shop this morning—in any case you won't have to figure as hard as our friend Beckwith did to get an extra Cleveland hammer. You remember he just kept ordering repairs a piece at a time until one day he threw the repairs together and the shop had an extra hammer. Push that tab over here and I will put you next to the only branch pipe that was ever put up in front of a good injector—the pipe that my injectors deserve. Don't be afraid of them; they won't freeze here—they have been running into St. Paul for years."

Turner was an exception to the general rule—he could do a couple of things at a time, both fairly well, and while talking was busy making a sketch, which he tossed over to the M. M. Continuing, he said: "Say, do you remember that 'Q' train I cut in two in the Seventh street crossing years ago? If I had a decent branch pipe instead of those on the '423,' I could have seen that fellow. It was 32 below zero that night. How cold next day? About 62 in the Old Man's office when I went up there. He had steam sizzling out of the radiators, too. You know the old man cared more about the '423' than all the other engines together—used to run her himself. Her right squirt would not hold her up with seven cars, so I put the heater on that side and let the fireboy pump her. Well, that same cloud of steam Wilson was kicking about hid the 'Q' train. Yes, I helped thaw out the Old Man's office, but I have been selling squirts since. Here, all you need do with the pipes on the '700's' is to pull them down, swap the boiler checks side for side, after making them over into globe valves. If you are too poor to buy new angle valves, then start the pipe upwards for about 10 inches, thence back in a straight line to front end of slope sheet, upward in line with that sheet, and back to the in-

jector, putting a good, substantial swing check in front of the injector, and you have it; no need for frost pipes with this *trust.*"

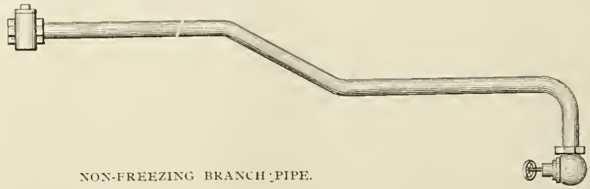
The M. M. looked at the sketch and asked, "Where do you get your circulation? This thing will freeze sure unless you can keep things moving." "You'll get all the circulation needed," answered the supply man. "Any school philosophy will explain how the cooler and more dense water will flow downward by reason of its greater gravity, lighter and warmer water rising to take its place. When you want a heater to keep the feed pipes open the least crack of the throttle will do the biz, and that condenses in the tank; no water wasted. Say, tell the generalissimo about that; you say he is kicking on paying for water cars."

"Sort of cure-all," remarked the M. M.

"No, I don't exploit shot-gun remedies as a general thing," said Turner; "but there are worse things than shot-gun remedies. This pipe has several good points. To begin with, the checks are up above the mud line. Did it ever occur to you that the average boiler check is a settling place for mud? The natural circulation of the boiler deposits it in the quiet places, where it bakes, clogging up the check valve—rhat means money, grinding check, emptying and filling boiler. Did you say you were short of engines? It takes time to do that job.

"These checks won't need much grinding; nothing but feed water reaches them. If you have to grind one in occasionally you need not disturb the water at all. In a pinch they can be ground in with a little steam on the boiler—enough to work the blower. Those pipes would be great on the little Bloods, down on your feeble-minded division—them with those 'befo' de waar' squirts, you know it takes the eagle-eye, fireboy and head shack to start one of them sometimes. The boys could close the angle valve until the curiosity primed, then open her up and flush things—might save a few failures. There's Cassidy that runs the '35'; he had to kill her one night last fall; the stem of the blow-back valve broke off and lodged under the boiler check. When he shut the squirt off, the check sat down on the broken stem. I was on '6' that night. If he had this pipe Cassidy would have closed the angle valve, put the left gun on, and Kissinger would not have had to walk five miles. You better let me send you a couple dozen No. 7 to put on them Bloods with up-to-date pipes. I'll fix the P. A. for you; we will take him out next time we go to Chicago."

"Turner," replied the M. M., "if old man Hennessy was wise, a couple of them old injectors would get lost every time they have an air-brake failure; that's what would happen with me." "Well, come down to the hotel this evening. I will look up Barnes, the superintendent, and we will see the show at the Grand. You fellows ought to get closer together. You all pull out of the same sack on the twenty-second—too much strangeness among you; your wives get along all right—you can if you try. I saw the company on '4' this morning. There was a little blond among them. Higgins saw them at Swiftville and he says she's all right." "Oh, ring off," said the M. M. "When you are married as long as I have been you will lose interest in blonds. I will give this sketch to Jacobs and let him try his hand putting the pipes on that '784' that went in yesterday. If they work I will shock old man Hennessy's nerves by ordering some of your No. 7's for the little Bloods—give them new branch pipes, too. Them little mills are good for years yet.



NON-FREEZING BRANCH PIPE.

Railway & Locomotive Engineering

Light in Darkest Africa.

Lagos is on an island on the gold coast of West Africa, not far from the mouth of the Niger River. It has a capital city and a population of 100,000 people in an area of 30 by 50 miles. Being a very rich little tropical island, with a large export trade in palm nuts and oil, cotton, gums, ivory, India rubber, cocoa and coffee, the British Government has constructed a railroad to reach the plantations. In dull seasons the little black natives of the town enjoy many a novel excursion into the fertile interior.

AN EXCURSION IN TROPICAL AFRICA: LAGOS CHILDREN OFF FOR A DAY IN THE COUNTRY.

A light has entered the interior of Africa; it is the locomotive headlight. From every coast, north, west, east, longer or shorter lengths of iron tracks are being pushed across sand beaches, up rugged slopes, through the forests, across lofty plateaus and broad deserts to fertile valleys and oases. France is running down into the Desert of Sahara from Algiers; England is reaching oward the old gold mines of Egypt; Portugal is penetrating the valley of the Zambesi; Belgium intends to tap the headwaters of the Nile through the Congo Free State, and Germany to people the agricultural land behind and above the worthless coast of German West Africa. Cape Colony, Natal and the two Dutch Republics already have lines running from Cape Town, Port Elizabeth, Durban and Lorenzo Marques clear up to Bulawayo, thus penetrating the dark continent from the south for fully a thousand miles.

All of these tentative feelers can have, ultimately, but one result. Some day there will be at least four great transcontinental lines across Africa. One will run from the Cape to Cairo and be crossed at Albert Nyanza or Tanganyika by the line from Stanley Falls to Mombassa on the Indian Ocean. At least two more lines will traverse the Sahara Desert and connect the fertile regions on the Mediterranean and Guinea coasts. When that time comes Lagos will be a much more familiar word than it is to-day.—*The Little Chronicle.*

General Correspondence.

Water Tube Locomotive Boiler.

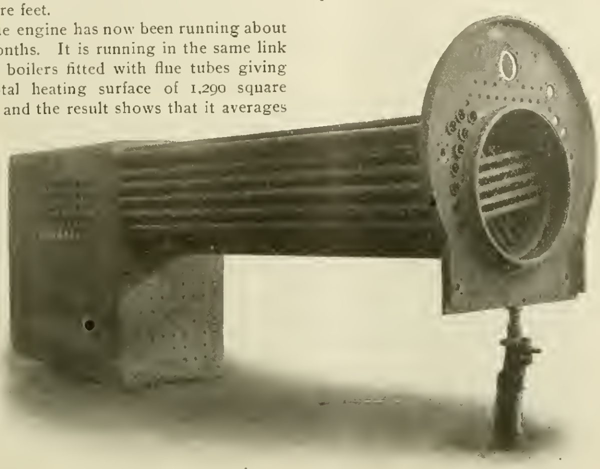
I hand you herewith photographs showing the boiler of one of our Mixed Traffic Engines fitted with water tubes in the flue, in place of flue tubes in the boiler. The total heating surface is 736 square feet.

The engine has now been running about 3 months. It is running in the same link with boilers fitted with flue tubes giving a total heating surface of 1,290 square feet, and the result shows that it averages 1 lb. of coal per mile less than the engines doing the same work fitted with flue tubes.

Should you desire any further information with regard to this boiler I shall be pleased to furnish it. D. DRUMMOND,

Locomotive Superintendent.

Nine Elms Works,
London & South Western Railway.



WATER TUBE BOILER WITHOUT SHELL—LONDON & SOUTHWESTERN RAILWAY.

A Compliment for Mr. Bell.

I see that an implied, though doubtless though doubtless unintended, compliment has been paid me by Mr. Frank C. Hudson, on page 69, in holding that a statement made by me is "about equivalent" to one made by Prof. Goss. A good artist never finds it necessary to write "this is a horse" under his picture, and in making the statement that the exhaust from a wide fire-box engine is "soft and mushy," as compared with the sharp bark of a narrow fire-box engine (to which I adhere, notwithstanding the supposed clear refutation alluded to by Mr. Hudson), it seemed superfluous to add the obvious reason that the difference was due to the larger nozzle admissible with, and indicated by Mr. Quayle to be used in, the wide fire-box engine. Attacks, either covert or open, on the wide fire-box, would not seem to be supported by present locomotive practice.

Pittsburg, Pa. J. SNOWDEN BELL.

Flash Point of Smoke.

A striking corroboration of the accuracy of the statement made in your current issue (p. 72) that there is "a flashing point for smoke" is afforded in a case reported a few days ago.

A fireproof safe containing half a million dollars worth of unregistered bonds and other valuable papers belonging, it is said, to the Attorney General of the State of New Jersey was found intact in the ruins of the fire at Paterson, N. J. When the safe had been cooled on the outside sufficiently to handle conveniently it was opened and instantly the smoke inside, from charred wood linings of the closets, burst into flame and the bonds and papers were consumed before they could be rescued.

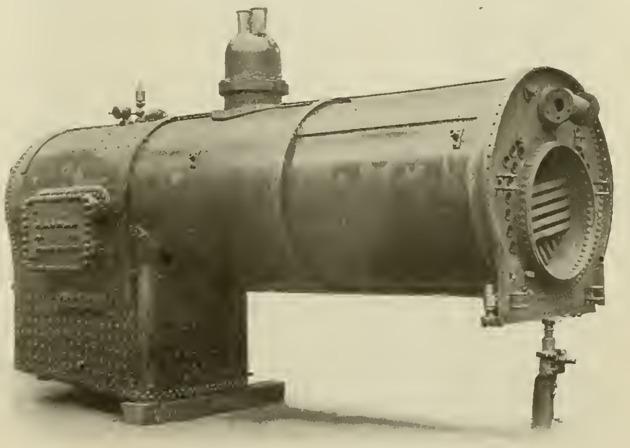
It is said that there were no flames in the vicinity when the safe was opened.

A. E. OUTERBRIDGE, JR.

(We do not think that the case illustrates so much the flashing point of smoke as it does the fact that any highly heated combustible substance will burst into flame when supplied with oxygen. We have frequently heard of the contents of safes that had been in a fire getting burned because the doors were opened before the contents were permitted to cool.)

Suggestion About By-Pass Lever.

I would like to make a suggestion or two in regard to the four-cylinder compound locomotives on this road. The levers and connections through which the engineer controls the by-passes are so arranged that when the front lever on cylinders strikes an obstruction the lever in cab is thrown back with great force. As a result we have three engineers laid up with injured knee-caps. Of course this feature never occurred to the designer, but it can readily be seen that if the connections were changed so that the lever would be thrown forward, it would be an improvement.



WATER TUBE BOILER COMPLETE—LONDON & SOUTHWESTERN RAILWAY.

I would also suggest cutting out a recess in the front of the cross-head, between the guides, to allow a little more room for oiling rod packing when the piston is at extreme forward end of stroke.

GEORGE T. SMYSER.

Cumberland, Md.

Handy Shop Kinks.

BY R. T. SHEA.

CHUCK FOR ROD BRASSES.

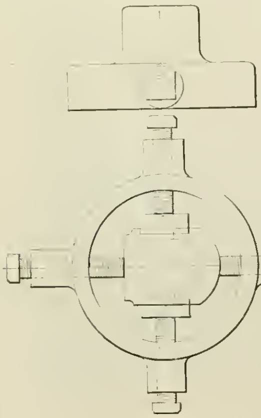
The accompanying sketch shows a chuck designed by Mr. F. S. Miller, machinist of the Creston (Iowa) shops. It is a neat compact affair, and is intended to hold the front end of a main rod brass used in solid end main rods of the Mogul type.

It will be readily seen that with the aid of this tool the brass can be put in the chuck set and bored out ready for use in less time than it would take to clamp it to the face-plate under ordinary conditions. As most lathes are equipped with four-jaw chucks this work is always clamped to the face-plate. If the lathes were equipped with four-jaw chucks, this tool would still be worth its cost to the company, as it could be applied to the machine and the work set so much quicker and easier than with the four-jaw chuck that it would more than pay to adopt it.

SHIELD TO KEEP CHIPS FROM FLYING.

The above sketch represents a galvanized iron shield fastened to the table of a slotter. The idea seems to be entirely new and quite novel, and was originated by Mr. Hoffman, slotter man in the Havelock shops at Havelock, Neb. It clamps around the table and forms a sort of fence to keep chips from flying.

By a little thought it will be readily seen that this is a valuable kink, as under ordinary conditions the brass chips will fly all over the machine and the floor



CHUCKING ROD BRASSES.

surrounding, and in addition to this the sand and grit fall on the ways and working parts of the machine and cause them to gum and catch. By the use of this shield all this is prevented and there is very little loss on account of chips flying off and the table is easily cleaned, and, where scrap brass is worth from 5 to 11 cents a pound, it is quite an important item to save it all.

It occurred to the writer that this same idea could be profitably employed on other brass-working machinery.

WRENCH FOR STUDS.

Sketch No. 3 is a handy tool for removing and replacing studs, and is quite an improvement over the ordinary aligator wrench. It can be made any size, to suit conditions.

DRILL AND REAMER.

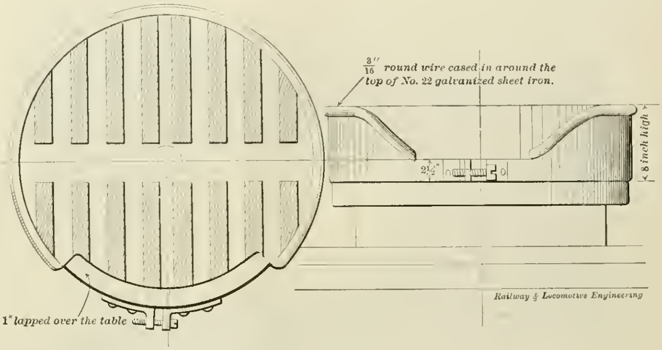
Sketch No. 4 is a very handy drill and reamer combined, for drilling and reaming smoke arch and saddle holes. The sketch readily explains the way it is to be used.

These tools are in use in the Colorado & Southern Railroad shops at Denver, and were designed by the general foreman.

Leaky Exhaust and Steam Pipes.

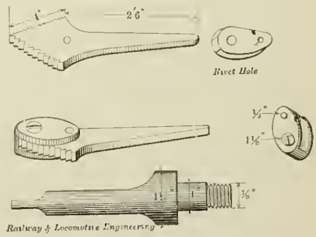
In the January number Mr. A. J. O'Hara asks why a comparatively slight leak in front end from steam pipes or exhaust pipe joint effects the steaming of engine so seriously when such leaks do not blow back against the flues.

It makes no difference whether the leaks referred to blow against the flues or not. It is not the force of the leak operating against the current of circulation as a counter current that influences the draft, but the mere presence of steam in front end other than the exhaust itself passing up and out through stack in



SHIELD FOR SLOTTER TO PREVENT CHIPS FLYING.

the regular way will cause the engine to steam badly, for the reason that whatever the volume of this steam leaking into the front end, that volume after being expanded by the higher temperature of the smoke box represents a corresponding loss of circulation of air through the fire, or it will perhaps be better to say that there might be leak enough in the front end to supply the vacuum created



STUD WRENCH, DRILL AND REAMER.

therein, or rather prevent the formation of any vacuum at all, in which case there would be no circulation of air whatever through fire.

When a nozzle box joint leaks, the air in front end is not drawn into leak, the steam is forced out into front end, and although the steam, having been used, does not represent a real waste from the boiler, its effect on the steaming of the engine is worse than if the same volume came direct from boiler to the atmos-

Credit to Whom Credit is Due.

Railroad men generally were amused at the newspaper account of the recent fast run of the J. Pierpont Morgan special train between Philadelphia and New York. The run was over the Philadelphia & Reading. The time made broke all previous records and certain due credit therefor should go to whoever made it. The daily papers seemed to think the conductor of the train was the man, and one daily had the photo of that gentleman, larger and more prominent than that of the great financier and the descriptive picture of the run. In this latter picture was the famous "bicycle engine" (one pair of drivers) of the Reading road, and out of the cab leaned a wild-eyed individual, presumably the engineer who made the run. With all due respect to the conductor who probably carries his unsought "honors" well, we cannot easily dismiss the conviction that to hang on to a careening locomotive shaking off miles in 39 to 43 seconds requires more skill and nerve and should bring more credit for such a performance that would the mere sitting down and going along on such a nerve-racking trip. If the engineer is not to be counted in the distribution of credit, why not then give a part of it to the Reading officials who accompanied the train, the train dispatcher who kept the track clear or the fireman who "kept her hot"? Or even to Mr. Morgan, who was there, too!

ROBERT MASON.

phere, and it is safe to say that a quantity of steam leaking from any point outside of smoke box that would be hardly noticeable in the steaming of the engine, might, if leaking into smoke box, make the engine perfectly useless.

THOS. P. WHELAN.

A Large Boiler on a Small Car.

I enclose a sketch of a boiler weighing about 24 tons, 16 feet long, 10 feet in diameter, with a ⅞-inch iron shell and 277—3-inch flues. It was manufactured by Higgie Bros., at Joliet, Ill., and shipped to Jerome, Ariz., to be used in the mines. At this point it was transferred to a narrow gage car, as shown. This car was designed and built by J. H. Brown, foreman of car department, of Junction, Ariz., and re-shipped to Jerome, via the United Verde & Pacific R. R.

O. VAN VOLKENBURG.

Junction, Ariz.

LARGE BOILER ON SMALL CAR.

The Plant System Locomotive.

I was much pleased to see the illustrations of the new Baldwin locomotive for the plant system, and believe it will do good work. If a balanced engine is of sufficient value to warrant the extra expense this will certainly do the work in good shape.

It strikes me as a little peculiar, however, that the plan of the engine should be so different from the designs shown in your issue of May, 1901, which were, I suppose, taken from the patent specifications. In that the high pressure cylinder was shown connected to the crank axle of the forward wheels, while the low pressure was coupled outside to the middle pair of wheels. This was a novel design, but probably made the inside connecting rod too short and the outside rod too long.

The main thing I like about the Vanderbilt tank is the ease with which the trucks can be got at for inspection or repairs. It is not a thing of beauty according to my notion, but can probably be built cheaper than the other style. It seems, however, as though it must necessarily be longer for the same capacity as the corners are wasted except in the forward part where the coal is carried. This is a good feature about the tank which could be adopted on the other as well. The coal belongs in front so that it will always feed down to the fireman or the stoker, if one is used.

Many roads are building tanks with coal space so arranged that it feeds forward by gravity or jar—or both—and it seems the only way in either case.

Scranton, Pa. H. FRANKLIN.

Pneumatic Belt Shifter.

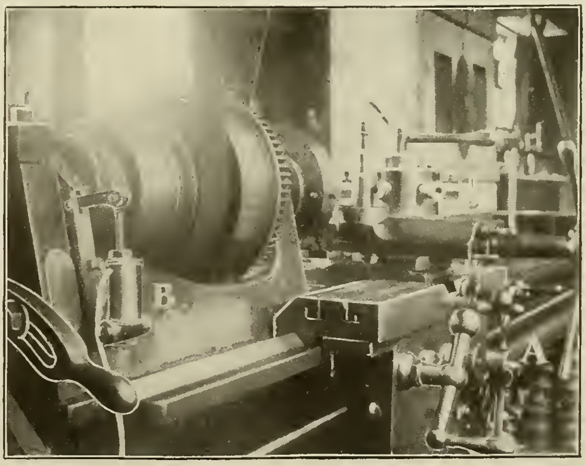
I send photograph of my new combined pneumatic belt shifter and brake recently devised and applied to an 18-inch Lodge & Davis engine and turret lathe.

By using this style of shifter on machinery engaged in manufacturing brass and other high speed products there is considerable saving in time. The lathe in question is being used in the manufacture of locomotive brass work, such as valves, cocks, and more particularly in boring and tapping all kinds of brass nuts. All of this work is usually done without the use of back gears and at a high rate of speed.

One of the most important items in the way of time, is the matter of starting and stopping this class of machinery—a very conservative estimate would be about one-fifth of all the time consumed would be used up in this manner; that is, with the old style of shifter.

The new shifter is designed and applied in such a manner that the valve is located on the apron of the carriage marked *A* in the photograph. This is the most natural position, as the operator has all feed and other handles on the apron, and does not have to change his position to start or stop the machine.

The brake is an ordinary hand brake using a one inch belt inside of a steel band and grips a brass band wheel of 5½ inches diameter. The valve is connected at the back of lathe with rubber hose to the reversing gear cylinders, so travels along with the carriage. The countershaft is not changed much, being connected with the reversing gear by two ⅜-inch iron rods with turn buckles for adjustment, which are connected at the top with an arm that works the shifter rod.



PNEUMATIC BELT SHIFTER.

The whole thing is a neat arrangement,

is out of the way and makes it a pleasure to run this lathe, where formerly the operator's arm was usually pretty tired when the six o'clock whistle blew.

St. Paul, Minn. ALFRED MUNCH.

Instruction of Queen and Crescent Train Men.

To describe the training and education of transportation employees on the Cincinnati, New Orleans and Texas Pacific Railway and the discipline of the men, it will be necessary to give particulars of the causes that led to the system. In the account of disasters on railroads, there is usually something beyond the statement of "disobedience of orders" and many other statements that appear either in public print or the private investigation, let it be ever so thorough. We hear of bad judgment when there is actually a question if it was possible to use any reasoning judgment whatever. To reason takes time and the necessity of action immediately in the presence of danger, makes reasoning impossible. Fortunately the brain has other powers that assist in supplying this defect. That function of the brain, that in one case we call mechanical action and in another force of habit, is most to be relied on if properly trained. The post office of the brain, as it has been called, or the central ganglin, as the medical profession know it, will, after proper training, receive an impression through any of the five senses and act on it with no thought whatever. A telegraph operator will receive and transcribe a message with no knowledge of its contents unless there is something in it that directly appeals to or interests him. By constantly repeating certain movements the channels of communication are developed and strengthened, until from an original thinking action it develops into a mechanical one, and instead of will power being necessary to perform the action it would require an effort not to do it, and sometimes a very strong one.

The repeated failures of the men to perform what appeared to be very simple duties was a problem that it was necessary to solve. It was desired that the fundamental truths be found if it was possible to find them. Men that were willing, industrious, earnest and loyal in the performance of their duties made grave mistakes. Discipline in the shape of punishment as in the old system, or humiliation as in some of the later systems, hardly seemed to give the desired result. All had some effect, and the only question now is, can we go still further? Perfection in any branch of business is not probable, but in a business as young as the railroad business much can be done to better it. In the single track system of railroad operation in the United States, the safety of operation depends largely on the memory of the train employees and the telegraph operators. Any failure to recollect at the proper moment makes a disaster possible. The system has been revised and remodeled many times, but this feature remains. The employee who forgets is usually subjected to punishment, but it is very doubtful if any punishment or humiliation will remedy a defective memory. It is very probable that it is a physical defect and cannot be remedied. The power to recollect in the normal brain can be trained to a very high degree, and we find many cases where it is.

Our experience is that the younger we get the man the more easily he is trained and educated, and that after certain ages are attained which differ slightly in different men, anything like thorough training is impossible. When any brakeman or fireman enters the service, he must have a thorough knowledge of all the rules connected with his duties before he works at all. He must not only know it but know it well enough to repeat it without hesitation, and many applicants have been rejected on account of their inability to answer the examination questions promptly. The sight and color tests are also made at the same time.

The next step is the periodical examinations. These are always held in classes and usually the same questions are given to each one present as far as they apply to their vocation. In this manner the new men get the benefit of the questions, answers and also the correction of the older ones, engineers, conductors, firemen and brakemen being all in one class together. These examinations are on train rules and train operations. They are really training classes instead of examinations. They are much more satisfactory to the men than an examination of each man by himself. He might feel inclined to differ with his teacher, but he instantly succumbs to what he feels to be the opinion of the majority of his comrades. It makes the understanding uniform. The result is that the young men learn very quickly, and when the time comes for promotion, they pass good examinations and are ready to assume higher responsibilities.

These examinations are followed later on in smaller classes by an examination by the board of examiners, consisting of the master mechanic, train master and chief train dispatcher. The master mechanic examines on mechanical affairs, repairing and handling broken trucks, cars, hot boxes, etc.; and for engineer's firemen all matters concerning the handling of engines, coal, oil and temporary repairs. When these examinations are held, the percentage of each person is worked out and a certificate made out in accordance. By this method a constant check is kept on the progress of the men.

In these examinations it was very difficult to ask some of the questions without suggesting the answer, and in the signal part it was extremely difficult to state the question at all. To overcome this, small models of the fixed signals and drawings of the train signals were made, but it was impracticable to display them in view of the whole class at once. The idea of using the stereopticon was then adopted. Slides made first of fixed signals, train signals. Then color slides for color examinations (instead of yarns), and later of engine and car repairs, first showing the break and then the engine or car after temporary repairs had been made. The application in this line is practically inexhaustible, as a slide taken once of the lifting in various stages of derailed engines or cars is an object lesson forever. This was especially valuable to us on account of the large number of signals that had been placed on the line, and it was essential that the men thoroughly understand them. They must be so thoroughly understood that the action would be instantaneous. It must not be necessary to wait to reason out the situation, but the eye must see and the hand act almost simultaneously. The nearer this result is attained the nearer is safety. With interlocking switches and signals, every engineman must know which arm governs his train and which arm indicates the main line beyond, or a diverging route. It is generally assumed when the signals are installed and the circulars issued that they are understood. It would be very fortunate if this was true, but in one case the rules governing the operation of the ordinary train order signals were discussed when a lecture was given with the stereopticon on another line, and the opinions of the division officers were diametrically opposite. In another case, on another line, it was demonstrated that only the upper signal on the main line mast was understood by the train men on an interlocking signal having two masts and two arms to each mast. The understanding of other signals were only conjectures.

When the staff system was installed on part of the line, the departure from the old system was so wide that especial pains was taken to educate the men. Slides were made of the staff machine, the signals and everything connected with them to make the working clear. The staff block system was installed on a portion of the road where the business was heaviest, and the operation by train order too cumbersome to endure any longer. The staff block in operation is governed entirely by the signals and the staff, there being no authority to use the track by class, direction or right. The possession of a staff and the signals being in proper position gives a train the absolute right of track in the block and the train can move backward or forward with no other authority and without the protection of a flag.

The two staff machines at the opposite end of the block are simply cases that hold (combined) thirty-one metal rods shaped to fit in the machine. The two machines are connected by electricity through line wires. When it is desired to send a train through the block, permission is requested by a bell signal and the operator at the opposite end of the block presses a lever which, electrically, unlocks the machine and a staff can be taken out. As this staff is taken out, it automatically locks both machines, and no more can be taken out until this staff is returned to one machine or the other. The staff is then used to unlock the semaphore signals and is then unjointed, and one part delivered to the engineer and one to the conductor, who must be on the rear car to receive it. As soon as the last car passes into the block the signal is returned to the stop position and cannot be moved to proceed until the staff carried by the train is in the staff machine at one end of the block or the other. The signals are locked, and the only obtainable key is on the train passing through the block.

This method of operation eliminates the memory part of the problem in the movement of trains on single lines. If the train men are trained to instantly obey a signal, there is no possibility of danger unless control of the train has been lost, and where this is possible a derail connected with the signals makes a collision impossible.

Another part of the examination, and although apparently small, essential to good practice is drilling the men on hand and lamp signals. We have made the rules and stated what the signals shall be, but not one railroad employee out of five will give the "go ahead" signal with the hand the same as he does with a lamp although the rules require it. The departures from the code are so many, however, that it would be useless to enumerate them. I have stated the ground work of the plan and the situation as we see it, but, in addition, each conductor is not only the commanding officer but the drill master of his train.

A. J. Love,
Assistant Superintendent.
Birmingham, Ala.

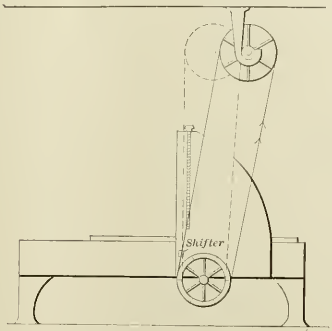
American Locomotives in Germany.

Apropos of the so-called invasion of Europe by American locomotives, and the placing in America by the Bavarian State Railways of an order for three Baldwin engines, I was recently in Nuremberg and heard several severe criticisms of these locomotives. The principal complaint appeared to be that the engines are much inferior to the Bavarian locomotives as regards lasting qualities. On leaving Nuremberg for Munich, I took the 6.44 P. M. train. Now, the best time made by express trains on this distance (about 125 miles) ordinarily is four hours. The 6.44 express landed its passengers in Munich in just three hours, without a stop, and even then did not appear to be making remarkable exertion. In going out of the station I stopped to see the locomotive that had played havoc with Bavarian speeds, and there, in plain letters, on a round brass plate, was the name of the Baldwin Locomotive Works, Philadelphia, Pa. Two Germans, who had come on the same train, and probably ridden faster than ever before in their lives, halted simultaneously, and I overheard one say to his companion: "See! that is one of the American locomotives. It looks all right, but is really not worth much."

Patriotism, it seems, is stronger than common sense. C. E. Carpenter.
C. O. Credit Lyonnais, Paris, France.

Making Switch Points on the Wauchusett Reservoir.

Having the first order of fifty switch points to make, I set about increasing the chip capacity of the planer. It had three



IMPROVING A PLANER.

pulleys, 1⅝ inches width of face, 12 inches diameter. New pulleys of larger diameter would do it, but the old ones were in good condition, so I lagged them with pine sawed out of ⅞ boards, six sections to the circle. First drilling and countersinking the rim of pulleys for wood screws to hold lagging to the iron, the lags were put on with plenty of hot glue, care being taken to break joints. Two thicknesses made ⅛ to be squared off on each side. When face was turned they were finished 15¼ inches diameter. Next the countershaft was set back to make the belt run right for the shipper *S*, and the shipper which formerly stood vertical was given a slight incline. The former position of countershaft and belt is shown by broken lines. It has been said that a wood-faced pulley was not the thing to slide a belt sideways on quickly and often, so the job was only a cheap experiment; but it has been in continuous use for two years and is all right. The belt has more traction on the wood surface, the 15¼-inch diameter gives more leverage than 12-inch, and putting the belt out of the vertical to an incline increases the tractive power. Result: Planer is more than doubled in chip capacity. W. C. Ovenden.
West Boylston, Mass.

Mistakes in Reporting Work.

Under the heading of the "Expense of Mistakes," in your last month's number, by Mr. F. P. Roesch, the average engineer comes in for a roast. Did you ever know a man who gets more of them, by the way? One superintendent I know roasts them because they get more pay than anyone else in train service. Maybe they earn it, too.

I would like to ask Mr. Roesch what is the proper report to place upon a roundhouse work report book when the engine is not steaming, the flues and firebox tight and a positive order in force prohibiting the engineer or fireman opening the front end. The engineer is the scapegoat for a whole lot of people to vent their spleen upon. He is expected to know more about his business than the conductor and is not permitted to set his judgment against that of a brakeman, unless the train comes to grief—then he's "it." So also he is called to go out at midnight on an engine he never saw, and is expected to diagnose every trouble from his (I was going to say seat) place in the cab. The physician comes into your house and asks what ails the patient. He gets pointers, and, looking wise, writes a prescription, gets your $2 and departs. The engineer is not permitted to go through the machine shop hardly, and when he gets to the end of his run, some petty whiffet forces the hostler to take the engine from the train before he even has time to feel the pins and journals. Of course the engineer can stay out of bed three or four hours and go to the roundhouse to look after the engine; but under the conditions of modern railroading where the company owns the engines, does it pay him? J. R. Dunt.
Pueblo, Colo.

The Passenger Department of the Chicago, Milwaukee and St. Paul are remarkably enterprising in taking hold of anything which will keep their road before the public. Some time ago they copied the speed cards first issued by Railway and Locomotive Engineering giving the speed up to 70 miles per hour. Now they have extended the card to 120 miles an hour with the intimation that travelers over the St. Paul require particulars of the higher velocities to keep them informed about how fast the trains are going. It is an excellent advertising scheme.

President Green of the Texas Midland has been granted a patent for a system of wireless telegraphy. Reports say that he will install the system upon the Midland as quickly as the necessary equipment can be made.

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The Staff System of Train Control.

Nearly all intelligent railroad men have heard something about the "train staff" system of train control, but very few of them have enjoyed the opportunity of examining the working of this system which has the extraordinary merit of making operating on a single track absolutely free from the danger of collisions. A visitor to Cincinnati will find the opportunity with very little personal inconvenience of watching the working of the train staff system upon the section of the Cincinnati, New Orleans & Texas Pacific, extending from the Union Station in Cincinnati to the south side of the bridge over the Ohio river. This system has been in use for several years and the officers in charge of train operating talk in the very highest terms about its efficiency and simplicity. When the Government was hurrying troops South at the beginning of the Spanish war tremendous strains were put upon the train service, but on this staff controlled block, the trains were moved like clockwork and there were no delays of any consequence and no congestion of trains caused by irregular movement.

The train staff system is electrically controlled and regulates the operation of an apparatus at each end of the block, which somewhat resembles grandfather's clock, the dial being perforated with holes for the staffs. The staff system in use on the Cincinnati, New Orleans & Texas Pacific is very different in many respects from the staff system which the writer had some acquaintance with in Great Britain, where it originated. There at first they used a single staff, and the engine driver was not permitted to pass over the block without having it in his possession. This caused annoying delays in many instances because one train following another had to wait at the beginning of the block until a train came along in the opposite direction and brought the staff. To obviate this difficulty a "train staff and ticket" arrangement was introduced. The ticket system provided for any number of trains going in either direction and when worked strictly according to the rules was just as safe as the single staff.

In the original primitive plan, an engine or train had to pass over the blocks alternately in each direction. Suppose the blocks along a division were named A, B, C, D and so on. An engine driver taking a train over these blocks received a staff at A, gave it up at B and received another staff, which permitted him to run to C, where it was given up and another received, and so the system was worked to the end of the division. The trains in the opposite direction were controlled in the same manner.

When the ticket system was introduced a number of wooden slips called tickets were used to permit the movement of several trains in succession in one direction over a certain block. The tickets were secured in a case which was opened by the staff acting as a key. The staff was carried by the last train going in any direction and no ticket could be taken out of the case until the staff reached a block point, so there was no danger of tickets being used on trains going in opposite directions and hence collisions were practically impossible. In the most improved staff system equipments block station signals are used, which interlock with the case containing the staff or tickets.

The system in use on the Queen & Crescent route was installed by the Union Switch & Signal Co., of Swissvale, Pa., and embraces the very latest improvements in the art of train staff signaling. The different block stations are electrically connected and the staff case works in unison with the block signals. When a train is about to enter upon the bridge block which we may call station A, mechanical consent is asked from station B to withdraw a staff from the instrument to be carried by the train. When this consent is given and the staff withdrawn no other staff can be withdrawn until that staff is placed in the case at station B, when permission can be given to withdraw another staff.

If, however, train from A to B is canceled, after a staff has been withdrawn at A it may be again returned to instrument at A, which will be indicated at B, and both instruments will be in the normal state again. The principle of the system is that two staffs cannot be taken out at the same time, nor can they be withdrawn consecutively. The removal of one staff locks both instruments against further removals, but either instrument remains open to receive the staff which has been taken out. Engines running over the section controlled by this system are provided with mechanism for picking up a staff after it has been withdrawn, and of delivering it at the other end of the section without stopping; but this is rather an adjunct to and not a part of the staff system. Signals are also operated by the pick-up and delivery devices, which indicate accurately the state of affairs.

A special form of instrument has also been devised, for use at a siding at some point between stations A and B. If a train with staff reaches the intermediate siding X, the staff carried by it is used in unlocking the switch, the train pulls in on the siding, if time limit, or other reason dictates this course, the switch being locked, the staff is placed in the siding instrument, and the instruments at A and B are synchronized so that trains may be sent from A to B, or from B to A. When these have passed through the sections and staffs have been placed in instruments at A or B, this causes the release of the staff at the siding, which on being removed, changes the circuits so that a staff cannot be released either at A or B until staff of the train from X has been deposited in one or other of the terminal instruments.

The people controlling this system of absolute block signaling for single track, are working out a variety of other improvements, most of them being for the purpose of facilitating the change of staffs. It costs considerable to install this system, but when once it is in operation, the expense of accidents is saved and a great may railroad companies would save money by using it, besides having their trains moved more promptly. A number of the more progressive railroad companies are using the train staff system to a limited extent and it is growing gradually into popularity.

To Prosecute Rebate Givers.

For years the Interstate Commerce Commission have been agitating in favor of Congress clothing them with extended powers, so that they could successfully prosecute railroad companies that are guilty of illegal practices in connection with rebate paying and rate cutting. Some railroad officials with much tenderness for the law breakers, have been daring the Interstate Commission to prosecute with the power at their command and have acted as if the whole question of adhering to rates and refusing to give rebates was a huge joke. Now, President Roosevelt has ordered the Interstate Commission to prosecute the law breakers and to do it vigorously, and there is something like consternation in the

camps of the jokers. They think that it will be prosecutions without convictions; but there is enough uncertainty about that to make it interesting.

It was expected that the increased "community of interest," resulting from leading capitalists securing control of so many railroads, would put an end to the secret rate cutting and to the giving of rebates to favored shippers; but there is good reason for believing that these forms of law breaking are carried on as flagrantly as they ever were. When railroad presidents and other influential officials meet together and talk for publication, the professions of virtue to be heard are simply astounding. Cutting rates? paying rebates? such things are never done on their lines. Their attitude reminds us of the way a railroad president of New York received a reporter from the New York *Tribune* which had published on the previous day a violent attack on the management of that road and on the president in particular. The reporter introduced himself as being from the New York *Tribune*, and wished to know what the president thought about the article. "*Tribune? Tribune?*" exclaimed the president. "Is it a newspaper?" "Yes, of course, it is a newspaper," replied the reporter; "and well you know it." "Never heard of it," said the president, as he assumed his favorite idiotic look; and he called in his confidential clerk and asked in a you-know-how-to-answer tone, "did you ever hear of a newspaper called the New York *Tribune?*" "Never," promptly replied the clerk. Several other officials were called in, and they all declared with one voice that they never heard of the New York *Tribune*. The reporter went away doubting if there was such a paper as that on which he was making his living, or thinking that he had fallen into a nest of maniacs.

So it is with the illegal practices followed by railroad officials. They have become so glib in denying that they cut rates or give rebates to favored shippers that they hardly know where they are at and almost believe that they are telling the truth when they deny the existence of illegal practices.

Utilizing Power of Streams.

All over the world the people who require power for industrial purposes are working out designs to harness the power represented by rushing streams and falling waters. Much activity in this direction prevails in the mountainous districts of Europe, and certain electrical engineers believe that in the near future some of the leading trunk railways in France, Switzerland and Italy will be operated by the streams that now run to waste down the mountain sides.

Electrical engineers in the United States are not ignoring the value of the potential power of our mountain streams, but there is more of a disposition to utilize the power for manufacturing purposes than for that of traction. A stupendous work of this character has lately been carried out in Montana, where power from the Missouri River has been carried a distance of 65 miles to Butte, Mont., where it is used mostly in connection with mining operations. Work is in progress which will greatly increase the amount of power transmitted, which already exceeds 5,000 horse power.

A dispatch from Helena to the New York *Sun*, relating to this great electric enterprise, says:

Extended to Anaconda, where the smelters are located, the new power will be the means of still further reducing the cost of treating the ore, as is the case in East Helena and Corbin. In these places coal is used only for the roasting furnaces.

For the purpose of transmitting the power to Butte the Missouri River Power Company, which owns the dam, constructed one of the most efficient pole lines in existence, providing against any possible interruption from storms, snow or ice. Each pole is protected by a new form of lighting arrester, as well as static interrupters, to protect the line and machinery against lightning.

Specially devised insulators, nine inches in diameter and a foot in height, composed of two pieces of glass are also a feature. Not only this, but the line is a double one. Should one line be interrupted the other would be ready for instant use.

More than 1,000,000 pounds of copper wire was used in the construction of this line, which has still another distinction in that it crosses the main divide of the Rocky Mountains in reaching its destination. The amount of potential transmitted is at present 8,000 horse power. The dam, power house and pole line represent an outlay of about $2,000,000.

The dam across the Missouri River is located at a picturesque spot—between two solid walls of rock, which forces backwater for five miles, thus insuring a never-falling supply. In addition, an immense artificial lake, covering 5,000 acres, has been built as a storage reservoir.

Electrical Operation of the Manhattan Elevated.

The conversion of the Manhattan Second Avenue Elevated Road to electric power from steam power progresses with increasing speed as time goes on. A week or two ago but a few electric trains were running and were being operated only during slack mid-day hours, the ordinary steam engine trains being used during rush hours solely, and also to help out the electric trains during the slack mid-day hours. This short term of probation for the electric trains is now past and they are doing all of the work during the slack mid-day hours and are being helped out during rush hours by the ordinary steam engine trains. In the course of another week or two the Second Avenue will be entirely equipped and operated with electric trains, then the conversion of the Third Avenue from steam to electricity will be begun, and will be followed closely by the Ninth and Sixth Avenue lines.

Much better time can be made with the electric trains between the Battery and Harlem than with the ordinary steam engine trains, this being primarily due to the quicker acceleration in starting up and the greater retardation of the more powerful Westinghouse quick action air-brakes in coming to a stop than can be obtained with the steam engine.

A most satisfactory feature of this conversion, to the engineers and fireman, at least, is the disposition of the engineers and firemen of the steam engines in the introduction of electric power on the Manhattan Elevated. The engineers are converted into motormen and receive their usual pay of $3.50 per day. The firemen receive their same rate of pay but are temporarily employed in various capacities in the new electric field of work. Some are conductors, others guards and still others are employed about the terminals where the trains are inspected and maintained and in the shops where new trains are being prepared. When a vacancy occurs for a motorman the oldest fireman will be promoted to the place and will receive the young engineer's rate of wages, viz., $2.50 per day as per the old, original schedule holding under steam operation. The third year he will receive $3.00 per day, and the fifth year and thenceforward, $3.50 per day. This leaves the rate of wages practically the same under electric operation of the road as they were with the ordinary steam service.

There is no doubt that the Manhattan road is thus far quite a little in the lead in the matter of electric equipment and operation, it having the advantage of the experience of the other elevated roads which have heretofore equipped with electric power, as well as being favored with the most recently designed electrical apparatus. The Second Avenue has passed from steam into electrical operation without a hitch of any kind, no delays or accidents being due to the installation or operation of the new electrical equipment. This is remarkable and decidedly complimentary to the management. Doubtless the major portion of the credit of this achievement is due to Mr. S. D. Smith, general superintendent, and J. S. Boyle, the master mechanic of electrical equipment. Both these gentlemen have risen from the ranks through the various intermediate stages of elevated railroading to the high positions they now occupy, and deserve the credit which they have honestly earned and which is justly theirs.

Relative Efficiency of Light and Heavy Locomotives.

We direct attention to an article in another part of this paper by Mr. F. P. Roesch on "Large vs. Small Locomotives," being a partial analysis of a series of comparative tests carried out by the Illinois Central Railroad Company last summer for the purpose of finding out the relative efficiency of moderate sized and very heavy locomotives in hauling freight trains. We have received from the officers of the company a performance sheet giving particulars of the work done by the different engines, and it contains many edifying facts not mentioned by Mr. Roesch. Four engines were employed, each to haul trains 10,000 miles over an undulating division 104.11 miles long, having a total ascent in one direction of 864 feet and a descent of 1,046 feet. The following are the leading particulars of the four engines:

ENG. NUMBER	TYPE	BUILDER	CYLINDERS	DRIVERS		WEIGHT				
				NO.	DIA.	ENGINE TRUCK	DRIVERS	TOTAL ENGINE	TOTAL TENDER	TOTAL ENG. & TEND.
35	10 Wheel	Rogers	20" x 28"	6	63"	34,900	122,300	157,200	102,000	259,200
489	Mogul	Brooks	19" x 26"	6	57"	16,900	106,400	126,000	80,000	206,000
639	Consol	Rogers	23" x 30"	8	57"	18,200	184,800	203,000	105,400	308,400
640	12 Wheel	Brooks	23" x 30"	8	57"	40,050	181,400	221,450	105,400	326,850

In analyzing the performance of the different engines, it is not necessary to deal with more than two of them, and we will follow the example of our correspondent and make comparisons of the performance of engines 35 and 639. All the engines made 96 trips, and in doing that, engine 35 hauled 2,480 loaded and 1,002 empty cars, the ton miles having been 10,763,613, the gross tonnage having been 103,386, an average train load of 1,077 tons. The speed maintained was 20.24 miles per hour, 563 tons of coal were used and 817,673 gallons of water, 6.028 pounds of water having been evaporated from tender temperature per pound of coal, and 17.69 miles having been run per ton. The average gage steam pressure was 177 pounds per square inch. The total cost for doing the work was $2,077.17. The rating of the engine for the ruling grades was 1,050 tons, and she hauled an average of 1,076 tons or 102.5 per cent. of the rating.

Engine 639 made 96 trips and hauled 145,738 gross tons, consisting of 3,144 loaded and 1,592 empty cars, the ton miles having been 15,172,803. The average train load was 1,518 tons, the rating having been 1,800 tons. The average speed maintained was 17.71 miles per hour; 915 tons of coal were used and 1,426,403 gallons of water, 6.491 pounds of water having been evaporated per pound of coal, 10.92 miles were run per ton of coal. The average gage steam pressure was 201 pounds per square inch. The total cost for doing the work was $2,817.65.

The coal used was kept as nearly uniform as possible. It was what might be regarded as an excellent steaming coal, having 47.86 per cent of fixed carbon and 37.96 per cent. of volatile matter. It contained elements which ought to have produced 1,262.2 heat units per pound of combustible if they were properly utilized by supplying the large percentage of hydrocarbons with the oxygen necessary to effect complete combustion.

One of the first things that strikes the investigator of the relative performance of these engines is that the lighter engine within its capacity performs the work of train hauling with decidedly greater efficiency than the large one. There is a current impression that the increase of efficiency of locomotives does not keep moving at the same pace as the increase of weight and size of parts. Why this should be so is a difficult problem to solve, for from an engineering standpoint the heavier engine is better proportioned than the smaller one and ought to be susceptible of a higher relative tonnage rating.

Engine 35 has cylinders 20 x 28 inches which aggregate 10.16 cubic feet for both sides. To supply the necessary steam to these cylinders there is a boiler provided with 2,396 square feet of heating surface, whcih gives 235.8 square feet for every solid foot of cubical content of cylinders. Engine 639 has cylinders 23 x 30 inches which is a total of 14.4 cubic feet and 3,500 square feet of heating surface is provided to supply the steam used or 243 square feet of heating surface for every single cubic foot of cylinder content.

From this it will be seen that the heavy engine has a greater relative steaming capacity than the small one, and therefore ought to do the work of train hauling with greater ease than its competitor—of course, there is some cause for the difference, but it is not easy of identification. In working over grades the heavier engine has to lift about 50,000 pounds more than the lighter one, that being the difference between the weight of the two engines, but that is a trifling difference, which could not account for the relative superiority of the light engine. We admit that we are puzzled to account for the difference in the efficiency of these two classes of engines and await for an explanation by some of our readers.

New Pay Schedule for the N. Y., N. H. & H.

The management of the New York, New Haven & Hartford Railroad have granted the following schedule of pay for their trainmen. The pay for trainmen, Class A, or passenger service, is to be as follows: Baggagemasters, $2.25 a day; brakemen, $2 a day; Class B, baggagemasters, $2.10 a day; brakemen, $2; train crews running 20 miles or over are allowed a day and a fifth. Class D, freight service, runs of 125 miles and over: Conductors, $3.25; flagmen, $2.25; brakemen, $2.70. Class E, over 110 miles, conductors, $3.25; flagmen, $2.25; brakemen, $2.10. Class F, under 110 miles, conductors, $3; flagmen, $2.10; brakemen, $2. Twelve hours to count as a day's work for these men with overtime to be paid at the rate of 1-10 the rate for the class interested. Way freightmen are to be paid as follows: When on the road over 8 hours the men are to get Class D rates; when less, Class B. In computing overtime the first 30 minutes to go to the company. With yardmen in yards of 8-hour shifts conductors are to get $2.75 a day, brakemen and switchmen, $1.95 per day. All other yards that were running 12½-hour shifts are now to run on a 10-hour basis, and in those yards conductors are to get $2.75 a day and brakemen $2.

The schedule is a compromise, and many of the men are far from being satisfied with it, but it is an improvement upon the old rates.

Railroad Trying to Raise Their Own Ties.

The question of systematic timber culture is commencing to be considered by the officials of American railways, and in some cases competent forestry officials have been secured to supervise the work. In one instance a plantation that was made about 15 years ago is beginning to yield, and from an initial outlay of $128,000, it is estimated that 1,280,000 trees worth $2 each standing will be obtained within the next ten years, affording a net profit of $2,432,000. In this plantation the trees were the Catalpa speciosa, and when grown are straight and clear of limbs up

to a small crown. The railroads of the United States consume about 1,000,000 acres of timber each year, as posts and ties have to be so frequently renewed and the expense is no small item. As many railways already have landscape gardeners, it has been suggested that practical forestry be add to their duties, and the trees, in addition to their value as timber, would be used to beautify the grounds of the stations along the way.

The officials of some railroads have come to a realizing sense of the fact that the only way to keep the price of ties and fence posts within reasonable limits is to grow their own timber. One railroad company in Indiana planted last season 50,000 catalpa trees at a cost of 1 cent per tree. This is the result of the experience of the railway that catalpa ties, a few samples of which were put on the track fifteen years ago, do not decay as rapidly as other woods. The average life of a white oak tie which has been used by the road is about eight or nine years. The expense of setting out the trees, including the preparation of the ground, fencing etc., has been but 1 cent for each of the 50,000 trees, in addition, of course, to the original cost and transportation of the trees.

The next thing in order for railroad companies is to provide themselves with preserving plants, where timber may receive treatment before being put into the ground.

Illinois Central Stockholders.

President Fish of the Illinois Central Railroad gave a very interesting address at the banquet given by the Baldwin Locomotive Works at Philadelphia in which he said: "When I entered the service of the company it had for years been paying cash dividends of 10 per cent. per annum, and we had in America only 338 stockholders, who owned but $3,451,500 of the then capital of $25,479,400, or less than one-seventh, and in Illinois we had only three—the president, the treasurer and a man who recently had been a director of the company—they together owned 157 shares, or $15,700. One concern in Holland then held nearly 30 per cent. of the entire capital, and more than half of the whole was owned in Great Britain.

At present 5,180 individuals living in this country own $57,723,600 of the stock, being nearly three-quarters (73.16 per cent.) of the whole capital of $79,200,000. Including some hundreds of our employees, we have 989 stockholders in Illinois who together own $7,857,500, which is nearly double the amount now owned in Holland. Fully one-half of the shares are owned in lots of $50,000 and less, and the average of all holdings is $10,385. There are, at home and abroad, 5,684 proprietors who own less than $10,000 apiece."

BOOK NOTICE.

The Prevention of Smoke Combined with the Economical Combustion of Fuel. By W. C. Popplewell, M. Sc., etc. New York: D. Van Nostrand. Price, $3.50.

Those who are interested in the long struggle which has been carried on in Great Britain to suppress or ameliorate the smoke nuisance will find this book good and edifying reading. From it they will obtain a history of what appliances have been invented to prevent smoke and particulars of the laws which have been enacted to compel commercial furnace users and other convertors of coal into smoke to change their ways; but, unfortunately, the author is not able to prove that important reforms have been effected. In this respect he is not much different from the public spirited citizens in the United States, who have waged a vigorous crusade against smoke, who have pointed out the evils of a smoke begrimed atmosphere, who have pointed out sure means of effecting a remedy, proved that fuel would be saved by adopting smoke-preventing appliances, and have been compelled to witness the evil growing in magnitude instead of diminishing.

After introducing his book by an interesting history of efforts made to prevent the omission of smoke from chimneys, and description of the evil effects of smoke in cities, the author gives an excellent chapter on "Fuels and Combustion," in which he describes the chemical action known as combustion, and points out how smoke is produced. The readers of RAILWAY AND LOCOMOTIVE ENGINEERING will find this part of the book a story they have often read, for the facts in different words have been repeatedly related in our pages. They say that a good story cannot be too often told, and we certainly believe that the reading of this chapter monthly by all boiler owners might bring forth works meet for repentance. We thoroughly commend the views of the author when he says: "An individual who is one of a community of many must be made to recognize that he must not do that which will produce ill effects on the health and comfort of the community of which he is a unit. Until this is recognized by the individual himself, and by the controlling authorities, to be as applicable to air pollution as to other nuisances, the smoke difficulty will not be overcome."

There are good descriptions, well illustrated, of a variety of furnace attachments invented to aid the fireman in hand-firing to do his work without causing smoke, and to enable him to maintain a fire that will burn the fuel with the least possible waste of heat. Apparatus of this character are very numerous and many of them work quite satisfactorily when properly managed; but none of them are better than a plain furnace when they are neglected. Stoking by mechanical means receives extended attention, and the leading mechanical stokers now upon the market are illustrated and described. This is a valuable part of the book and will make a useful reference for people interested in mechanical stokers. A few other subjects treated are powdered fuel firing; gaseous fuel; Siemens & Wilsons producers; the testing of boilers, and smoke observations; fuel calorimeters; standard smoke tests; the legal aspect of the smoke question; and the means adopted for lessening the smoke in our atmosphere. The book contains 203 pages, 5¼ x 8½ inches. The illustrations, typography and paper are excellent, but the price is too high.

The disposition of the average American traveler on American railroads to "kick" at the least delay, or other irregularity not on the train's schedule, is well known and sometimes painfully apparent to the long-suffering train crew. After all, the Yankee traveler has little to complain of. His railroad trains are nearly always on time, make better speed than those in Europe, and are more comfortable by far. That "busy" legislator who seeks to introduce bills for abnormally low passenger fares should make a journey through Great Britain, where the fares are about three times as great as in the United States. Such a trip might prove instructive to that individual and perhaps serve to key up his appreciation of reasonable fares.

BOILER

TYPE	WORKING PRESSURE	DIA.	FIREBOX		FLUES			HEATING SURFACE			GRATE AREA
			LENGTH	WIDTH	NUMBER	DIA.	LENGTH	TUBES	FIREBOX	TOTAL	
Wagontop	180	66"	120"	32"	304	2" O. D.	13'–11"	2,204□	192□	2,396□	27.22□
Belpaire	165	62"	114"	33"	236	2" O. D.	11'–1"	1,358.57	173.08	1,531.65	26.45□
Belpaire	210	80"	132"	42"	417	2" O. D.	13'–8"	2,982□	221□	3,203□	38.50□
Belpaire	210	82"	131"	41"	424	2" O. D.	14'–8"	3,237□	263□	3,500□	37.50□

Two New Baldwin Locomotives.

Widely different parts of the globe are represented by the two Baldwin locomotive illustrated with this, one going to the Southern Pacific and the other to far away India. The greatest similarity is that both of them are for freight service. Both are compound and both have straight boilers.

The Indian is for the Oudh & Rohilkund Railway, and is for 5 feet 6 inch gauge. It has copper firebox and brass tubes. The main dimensions follow:

Cylinder—20 x 24 inches.

Diameter—54 inches.

Working pressure—180 pounds.

Fuel—Soft coal.

Tubes—Number, 186; diameter 2 inches; length, 10 feet 8⅝ inches.

Heating Surface—Firebox, 102.2 square feet; tubes, 1025.3 square feet; total, 1127.5 square feet; great area, 16.6 square feet.

Driving Wheels—Diameter outside, 54¾ inches; journals, 7 x 8.

Engine Truck Wheels (Front)—Diameter, 29¼ inches; journals, 5 x 8 inches.

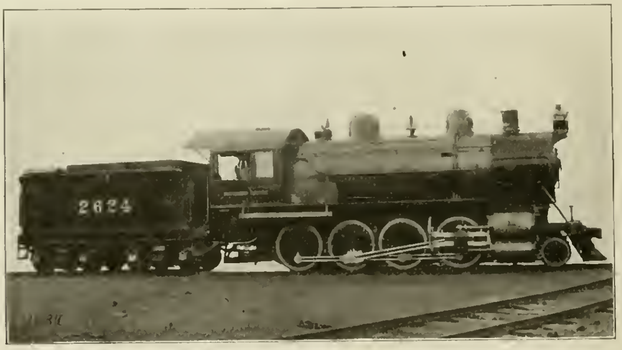
Wheel Base—Driving, 13 feet 11 inches; total engine, 21 feet 8 inches; total engine and tender, 41 feet 3 inches.

Weight—On driving wheels, 81,800 pounds; on truck (front), 18,800 pounds; total engine, 100,600 pounds; total engine and tender, 158,600 pounds.

Tank—Capacity, 2,160 gallons.

Tender—Wheels, diameter, 43 inches; journals, 4½ x 9 inches.

The Southern Pacific locomotive is much larger in every way, as will be seen from the main dimensions.



CONSOLIDATION FOR SOUTHERN PACIFIC.

Cylinder—17 x 28 x 30 inches.

Boiler—Diameter, 76$\frac{1}{16}$ inches; working pressure, 200 pounds; fuel, soft coal; staying radial.

Firebox—Length, 108 inches; width, 72½ inches.

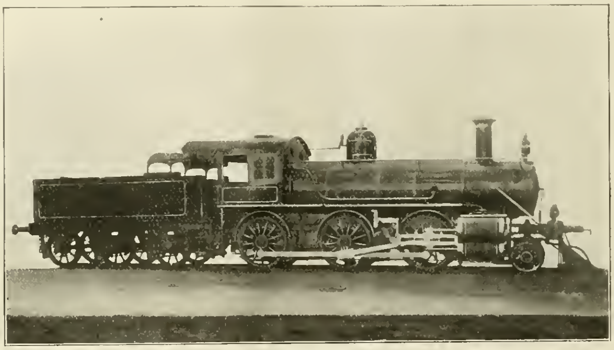
Tubes—Number 442; diameter 2 inches; length, 14 feet 9⅛ inches.

Heating Surface—Firebox, 208.1 square feet; tubes, 3390.7 square feet· total, 3598.8 square feet; grate area, 54.5 square feet.

Driving Wheels—Diameter outside, 57 inches; journals, main, 10 x 12 inches; others, 9 x 12 inches.

Engine Truck Wheels (Front)—Diameter, 30½ inches; journals, 6 x 10 inches.

Wheel Base—Driving, 15 feet 8 inches; total engine, 24 feet 4 inches; total engine and tender, 53 feet 2 inches.



BALDWIN MOGUL FOR INDIA.

Weight—On driving wheels, 181,200 pounds; on truck (front), 23,600 pounds; total engine, 204,800 pounds; total engine and tender, 325,000 pounds.

Tank—Capacity, 6,000 gallons.

Tender—Wheels, diameter, 33½ inches; journals, 5½ x 10 inches.

Creeping Rails.

BY THOS. P. WHELAN

During the past year there has been in some of the railway journals considerable discussion on the question of creeping of rails on roads having more than a single main track, on which the trains, consequently, run always in the same direction.

Investigation thus far has shown this effect to be traceable to the locomotive, for it has been found that on roads the right engine of whose locomotives is the leading one the creeping effect is produced in the left line of rail, while on roads whose locomotives have the left engine leading it is the opposite rail that creeps.

That being the case, as is proven by leading mechanical engineers on both sides of the water, the problem resolves itself into a question of locomotive construction and steam distribution, the combined effect of which produces an uneven wear of driving wheel tire that is no doubt the direct cause of rail creeping, as well as other evils that have been charged chiefly to counterbalancing.

The writer believes the so-called "hammer blow so destructive to trestles, bridges and permanent way" and which has usually been charged to counterbalancing is nothing more nor less than the direct effect of the locomotive driving wheels, the tires of which are worn out of round, the primary cause of which is the effect of steam distribution, even in the most perfectly designed locomotives.

With the right engine leading and right main pin standing on upper quarter, we will note the effect on driving boxes and tire during one revolution, with engine moving under steam, starting train.

When throttle is opened, steam is now admitted to rear end of right cylinder and the right main pin is pulled forward, bringing the right main box against the forward jaw in frame. The power exerted on the pin is also exerted at right end of main axle, which, with the forward jaw as a fulcrum causes the left end of axle to be forced back against the rear jaw (or wedge) on left side.

As the right pin leaves the upper quarter, steam is admitted to left cylinder, and whatever lost motion there may be on left side, owing to the driving box being back against rear jaw at time of taking steam, such lost motion is taken up without any appreciable jar, as the wheel rolls forward, carrying the box to its position against (its fulcrum) the forward jaw, and because of the wheel rolling to make this change of position of box there is no

unusual wear of tire at the point in contact with rail at that time.

When left pin has approached to near the upper quarter position, the exhaust has taken place on right side, and the propelling power being now wholly exerted on the left side, the right end of axle is, with the box, forced back against the rear jaw; so we find that when steam is admitted on right side there is no pound, as the lost motion has already been taken up by the box being forced against the rear jaw or wedge.

But now we come to the point where the damage to left tire is caused. When right pin has arrived near the lower quarter, the exhaust has taken place on left side, and as the propelling power is now wholly exerted against right main pin (backwards) the left end of axle, with driving box, is forced ahead against forward jaw, so that when the center is passed the steam pressure on left side must force that box back against the rear jaw (its fulcrum) before it can exert any power to aid in moving the engine; but in this case it should be observed that the wheel must move in a direction (backwards) opposite to that in which the engine is going, and in order to do this the wheel must slide back to bring the driving box against its fulcrum, the rear jaw, and it is this continual slide, slide, slide, once to each revolution of the wheel that develops abnormal wear of left tire at and immediately following the point in contact with rail when pin has just passed the forward dead center.

This action is of course reversed in locomotives, the left engine of which is the leading one, and that being the case it is reasonable to believe that the opposite line of rail would show a similar effect, which furnishes material aid in tracing from the effect to the cause of creeping of rails.

In what manner wheels worn out of round cause this peculiar action of the rails is of course another story.

A CRIMINAL WRECK.

ANOTHER VIEW—SAME WRECK.

A Criminal Wreck.

The disastrous wreck illustrated herewith happened on the Columbus, Sandusky and Hocking Railroad on February 19, and was caused by a broken rail. The conditions invited disaster. The railroad is in the hands of a receiver, Mr. Jos. Robinson, and that official did not employ trackwalkers. The train that ran into the hole left by the broken rail consisted of 73 cars and was double-headed, which tended to make the disaster much worse than it would have been with one engine on the train. The engineer of the first engine was killed and the fireman severely injured. Double heading such a train is criminal besides being miserable railroading. That engineer was murdered by the want of a trackwalker, aided by the pressure of an extra locomotive on the train.

Same as Attitude of Switchmen to Automatic Couplers.

In two important test prosecutions under the Factory Acts which Sheriff Fyfe, of Glasgow, had before him last month, the offenses were the failure of two saw-milling firms in Glasgow to fence the circular saws in their establishments. The plea of guilty was tendered in each case, but in one case the defense was that the workmen "prefer doing without the guards;" the foreman considered them "something of a nuisance," and had never known during an experience of over forty years of an accident that would have been prevented by the guards proposed. The Factory Acts inspector held that guards were a means of safety, they lessened the risk to anyone in front of the saw, and they unquestionably safe-guarded the "taker-off" at the back.

In regard to saw-mill accidents generally, these, he declared, had been reduced by 60 per cent. in his district by the adoption of guards. The Home-office two years ago issued a circular to inspectors calling their attention to the fact that in 1897 over 1,000 accidents had occurred to workmen employed at unprotected saws, and requiring the more stringent enforcement of the act. To these statements of facts the inspector added the opinion, formed from his long experience, that workmen generally opposed any recommendation such as the fitting up of guards.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Remodeled Instruction Car.

Instruction car No. 1 of the Westinghouse Air-Brake Company just comes from the shops, where it has been for several weeks undergoing repairs and modi-

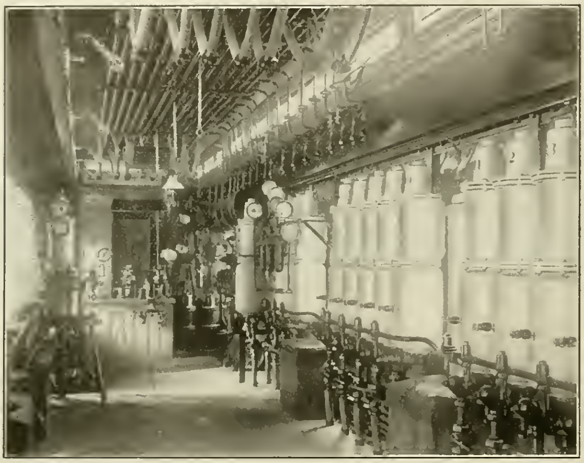


FIG. 1.—INTERIOR VIEW OF INSTRUCTION CAR.

fication. It enters commission again as, doubtless, the most complete and valuable of all brake instruction cars, from a viewpoint of practical utility.

The interior arrangement has been much

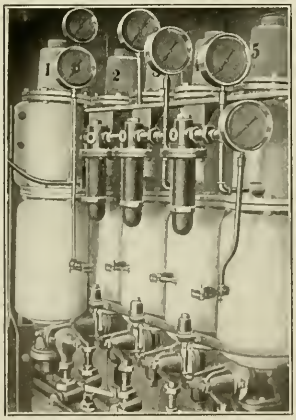


FIG 2.—HIGH SPEED BRAKES.

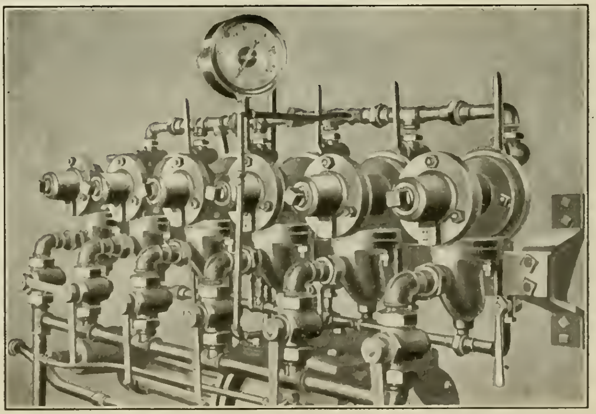


FIG. 4.—"BATTERY" OF DEFECTIVE TRIPLES.

changed and improved. Fig. 1 shows the general arrangement of apparatus. As will be seen, the brakes of the thirty-car train are placed vertically on the side walls of the car, giving more free floor space for larger classes. The brake cylinders and auxiliary reservoirs of this train have been painted white, while all other parts are black, as usual. It is debatable whether the brighter respective and indicative colors of the parts as introduced and employed by the Boston & Albany and the New York, New Haven & Hartford air-brake instruction cars, would have been generally preferable.

Fig. 2 shows the first four cars of the thirty-car freight train equipped with high-speed brake apparatus and suitable pressure gages.

Fig. 3 is rapidly becoming known among visitors to the car as "Brown's pulpit."

Fig. 4 is a view of the "battery" of defective triples. Each triple valve is made differently defective purposely to illustrate its own action, also its effect on other triples of the train.

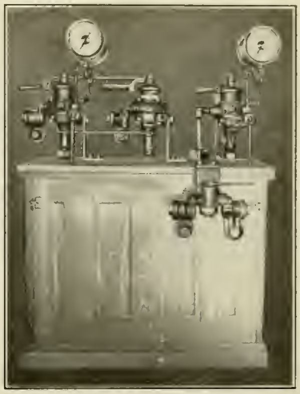


FIG. 3.—"BROWN'S PULPIT."

Fig. 5 exhibits the most interesting and valuable piece of instructive apparatus of the car, being a feature of marked ingenuity. It consists of a brake cylinder fitted with tandem-connected quick action triple valves, slack adjuster and high-speed brake reducing valve. A service application shows the operation of the plain part of the triple, through the tandem connection and the sectional triple; also the action of the high-speed brake reducing valve in ordinary train stopping. An

emergency application actuates both the service and quick action parts, which is strikingly shown in the sectional valve through the medium of the tandem connections, the high-speed brake reducing valve operating as in a sudden, emergency

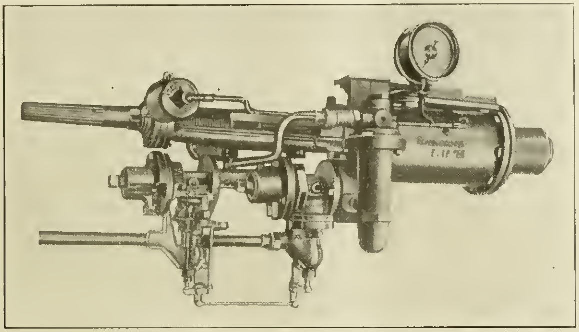


FIG. 5—TANDEM QUICK ACTION DEVICE IN "REST" POSITION.

stop on the road. A release shows the operation of the slack adjuster. The whole apparatus is mounted on a pivoted crane. Fig. 5 shows the crane and its parts resting normally against the wall.

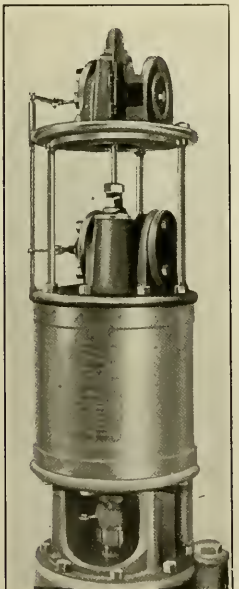


FIG. 8.—SECTIONAL TANDEM 9½ INCH HEAD.

Fig. 6 shows the crane and its contained apparatus swung away from the wall to a better position for a good view of the class.

Fig. 7 is a view of the 9½-inch air pump, with sectional head coupled tandem. This pump supplies pressure for all the car apparatus, and, while in operation, illustrates, by the movement of the parts in the sectional head, the working of the valve motion of the steam part of the pump.

Fig. 8 illustrates, more in detail, the tandem connections and sectional parts of the valve motion.

Fig. 9 shows the sectional brake valve coupled tandem to the working brake valve. As the handle is moved, the several positions of the rotary valve of the sectional brake valve are shown. When the equalizing piston of the working brake valve lifts, the connecting rod and cranks lift the piston of the sectional valve also. The third valve, at the right, is used to exhibit the operation of the parts of high-speed brake and high-pressure control (Schedule U").

Fig. 10 illustrates the action of the plain triple valve, also the high-speed reducing valve by sectional parts coupled tandem to the live, working valves, pressure gages being plentifully supplied.

Fig. 11 is a view of the car's lighting plant.

A striking feature, and one that is a distinct departure from the general order of

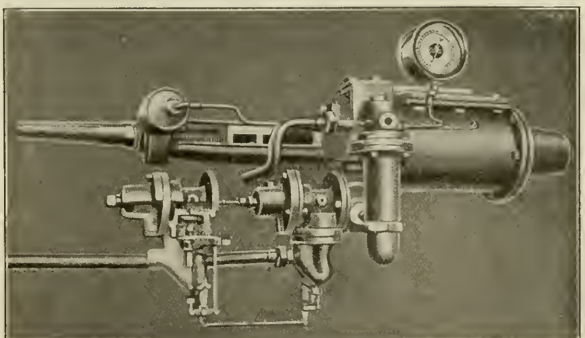


FIG. 6.—TANDEM SECTIONAL QUICK ACTION TRIPLES, SLACK ADJUSTER AND HIGH SPEED BRAKE APPARATUS.

things, is the foundation brake rigging of the car. Instead of a single 14-inch brake cylinder, with connections to both trucks, two 10-inch cylinders, auxiliary reservoirs, triple valves, slack adjusters and high-speed brake reducing valves are used, each set being integral with, and moving with the truck in all its movements. This requires a flexible connection from the train pipe to the triple valve on each truck, but the connection is so near the center bearing of the truck, and the movement there so little, that one rubber hose connection should outlive ten hose couplings between

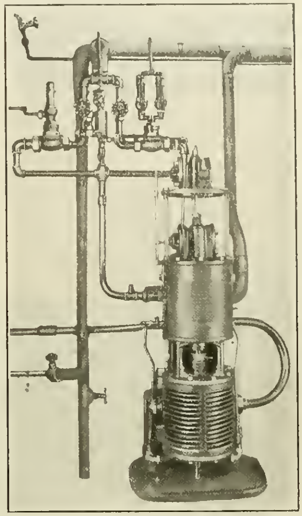


FIG. 7.—SECTIONAL TANDEM 9½ INCH HEAD AND PUMP.

cars. While this radical departure from the ordinary foundation brake rigging has been closely watched for weak points ever since the car left the shop, none have yet developed; and, instead, the new brake has performed so well that its superiority for very heavy cars seems favorably and forcibly assured.

The car body is mounted on two six-wheel trucks, is 60 feet long, and is painted the standard Pullman color. I. H. Brown is in charge, assisted by S. G. Downs, of Detroit, formerly air-brake instructor of the Michigan Central. C. A. Berry, of Pittsburg, is engineer and porter.

Air Brake Convention.

The ninth annual convention of the Air Brake Association will be held in Pittsburg, Pa., beginning April 29. The Monongahela House has been selected for convention headquarters. The meetings will be held in the hotel convention hall, the first day's meeting being called to order at 9 A. M., Tuesday morning, April 29. Convention rates have been secured as follows:

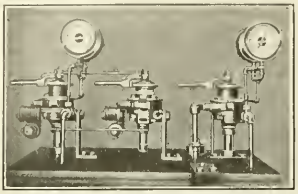


FIG. 9.—TANDEM BRAKE VALVES.

Monongahela House, American plan, one person, $3.00 per day and upwards; two persons in a room, $2.50 per day.

The Griswold, European plan, one person, $1.00, $1.50 and $2.00 per day; two persons in a room, 75 cents each.

St. Charles Hotel, American plan, $2.00.

The Lincoln, European plan, $1.50 and upwards.

Members are requested to stop at the Monongahela House, which has been selected as headquarters. At Union Station, take South Side Electric cars and ask the conductor to leave you off at the hotel. The B. & O. Station is diagonally across the street from the hotel. The Pittsburg & Lake Erie Station is at the opposite end of the Monongahela River bridge from the hotel. The other hotels mentioned are within two blocks of headquarters.

Anti-Pass Exchange and the Air-Brake Convention.

The agreement of the different railroads to abolish exchange passes which went into effect the first of the present year promises just now to work hardships in a direction least expected and may amount to considerable before it ends.

The ninth annual convention of the Air Brake Association, to be held in Pittsburg, April 29, will doubtless be very much curtailed in attendance because of the inability of the members who are employed in different branches of air brake work on the different railroads to secure transportation over other lines than their own to Pittsburg. The result is that only such air brake men as are employed by the roads entering Pittsburg will be able to attend the convention, unless the others see fit to go down into their pockets and pay their own fare with hard cash, or unless the railroad companies choose

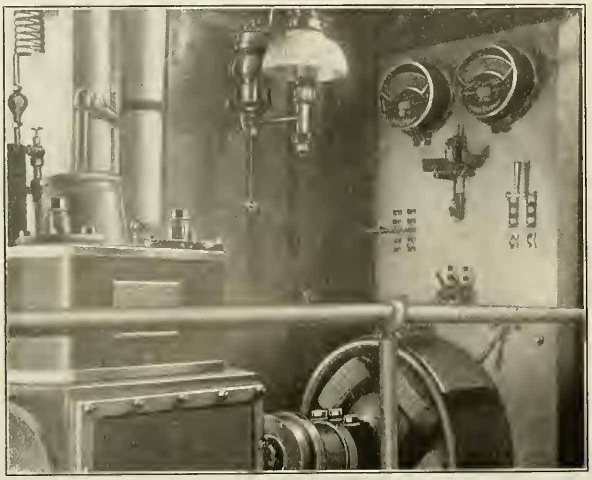


FIG. 11.—VIEW OF ELECTRIC LIGHTING PLANT.

to do this for them. It is to be regretted that such a serious hindrance is to be put on the effective work of this energetic young organization which has done so much in the past ten years to bring the air brake practice of railroads in general from a condition of total indifference and neglect to one of active efficiency. The Air Brake Association has been a valuable and appreciated feeder to the different railway clubs and to the Master Car Builders' Association. At the present time it is in close coöperation with the latter larger organization, dealing in the important matter of maintenance of freight brakes, labor costs, repairs, etc.; and while such a critical check to its usefulness and activity might not definitely disrupt the association, it would, nevertheless, closely approach it, and in one fatal blow set back the results of years of hard, conscientious work.

It would seem that the railroads can ill afford to permit the crushing out of this active, young, primary organization which has done its full share in making the train movement of American roads the admiration and study of foreign lines, simply because of an ill-fitting, distasteful fad that boomerangs unintended and innocent persons. Possibly the exchange pass agreement may be annulled or satisfactorily modified before the Master Car Builders and Master Mechanics meet in June. If it is not, the attendance at those conventions need not be curtailed considerably, as those who usually attend will prefer to pay fare rather than fall out of the moving procession; but the air-brake man will be obliged to miss his convention, as he, in almost all cases, cannot afford to pay railroad fare to attend conventions. The only crumb of comfort for him in the situation, therefore, is that the obnoxious agreement may be annulled before his convention time, or that his superior officers may see fit to buy him tickets over foreign roads in lieu of securing him free transportation as usual.

If all roads would now buy tickets where before they requested exchange passes, they could balance up with each other at the end of the year and find they stood just about in the same position they did when they issued free exchange passes. But will they do it? They may,

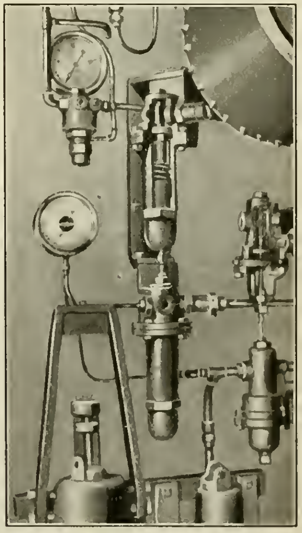


FIG. 10.—SECTIONAL TANDEM HIGH SPEED BRAKE, REDUCING VALVE AND PLAIN TRIPLE.

but it is extremely doubtful. In the meantime, the air-brake man sees his chances growing darker for attending his convention where it has been his wont to tell of the air brake practices on his road and learn in exchange the practice of others; for visiting the Westinghouse

air brake shops and learning more about his business; for acquiring information as to best and latest practices concerning air brakes that he can bring home and give to his own road. All this makes him feel blue and wish there was some known way to get around the anti-pass exchange agreement.

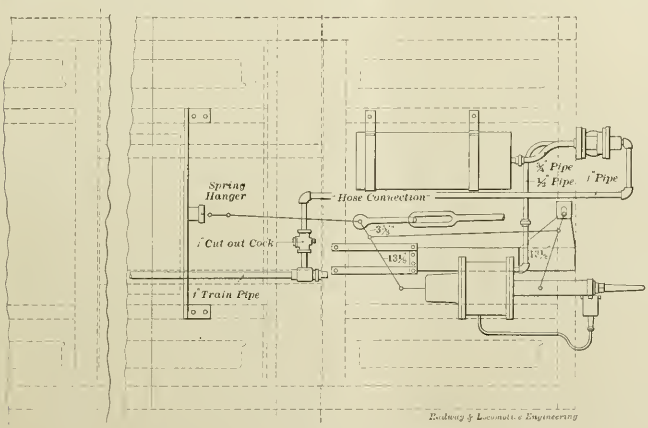
CORRESPONDENCE.

Regarding Q. and A. No. 137.

On page 127, answering question 137, a sentence reads: "In full release, both gage hands should register 90 pounds." This is a slip. The pressure in full release position ought to be 70 pounds, through trainline and main reservoir, unless the high speed brake is used, which is evidently not the case with "E. E. C."

Inwood, N. Y. A. P. Payson.

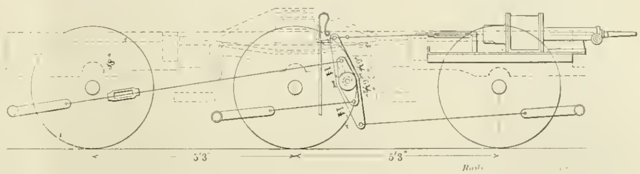
[The pump governor, being controlled by main reservoir pressure will permit main reservoir pressure to run up to 90 pounds in the train pipe with brake valve handle in full release position. The object of the "warning port" is to keep the handle out of full release position. The answer to question 137 is correct.—Ed.]



PLAIN VIEW OF DIVIDED OR TWIN BRAKE.

Probably First Form of Quick Action Triple Valve.

A train was made up as follows: Consolidated engine, 35 loaded freight cars and a caboose. The engine was equipped with New York brake apparatus. The 20 cars next to the engine equipped with the Westinghouse brake, and the rest were non-air cars. There was a plain triple on the engine and tender, and on the car next to the engine, and the rest were quick action triples. When stopping at a station, the engine made a 5-pound train line reduction and waited for the train to bunch. When he was making the second 5-pound reduction, all brakes went into emergency, causing a severe shock at the rear end of the train. The trainmen had not time to locate the trouble, as they had to make the next station for an express train. When stopping at the next station to take the siding, the brakes again went into emergency when the second 5-pound reduction was being made, causing the loads on some of the non-air cars to shift.



DIVIDED, OR TWIN BRAKES FOR SIX WHEEL TRUCKS.

The trainmen, after a time, located the trouble on the car next to the engine. It would not apply with the first 5-pound reduction, but would go into the emergency when the second reduction was being made. They cut this brake out and had no more trouble the rest of the run—about 75 miles. How was it the plain triple going into emergency caused all the quick action triples to do the same?

George Crawson.

Moncton, New Brunswick, Can.

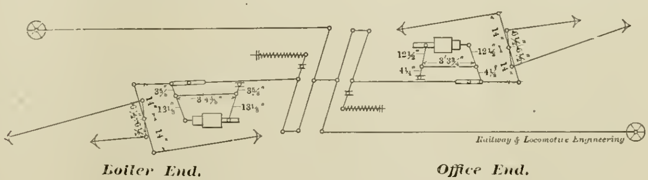
[The car next to the engine, instead of having a plain triple, probably had an old style, earlier form of quick action triple, which closely resembles the old, plain, freight triple. The cap was about two inches longer, otherwise the two triples looked very much alike. This was Mr. Westinghouse's first quick action triple. A number are still in service and occasionally give the trouble above mentioned. They are nearly always mistaken for plain freight triples. You can always tell by length of cap.—Ed.]

Air Straining Device for Air Pumps.

The accompanying cut shows a straining device for filtering the air passing to the air cylinder of the air pump. We do not know whether there is any patent on it or not; but presume there is not, inasmuch as similar devices have been used on several different occasions to our knowledge several years back.

The proprietors of this device, in advertising it, seem inclined to make rather extravagant claims and statements for it, going so far as to say that almost the sole cause of a pump running hot, is because the dust and dirt is not strained out of the air before it is admitted to the air cylinder. They further say that they guarantee to stop all this trouble and save nine-tenths of the cost of repairs to air cylinders, valves, packing, rings, etc., by installing their strainer device. This we have very grave doubts they will be able to do.

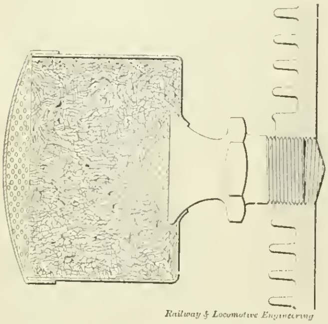
Like many other inventors, they overshadow the good points of the device by making extravagant and irrational claims for it. There is no doubt that a strainer will largely reduce the amount of dirt that enters the air cylinder, but it cannot possibly stop the natural wear of valves, cages, packing rings and cylinder. Of course, where grit is admitted, the wear is rapidly increased. So far as the heating of the pump is concerned, it should be remembered that a natural heating accompanies the compression of air, and no amount of straining will prevent the natural heating of pumps due to air compression.



LEVERAGE OF DIVIDED OR TWIN BRAKE.

Loop Connection for Driver Brake Cylinders.

The accompanying sketch shows a "loop" pipe connection for driver brake cylinders which is being successfully used on the New York Central. Experience has proved that driver brake cylinders, fastened to the guide yoke sheet under the boiler and between the frames, will sometimes work loose and are difficult to keep tight. When once loose, a strain is thrown on the rigid connecting pipe, and a leak is made, thus spoiling the effectiveness of the brake. The "loop" feature supplies a flexibility that prevents the pipe from breaking and permits the brake to remain effective during the interim the inspector is discovering the loose cylinder.



HAIR STRAINER FOR AIR PUMP.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(146) B. E. L., New London, Conn., asks:

What main reservoir capacity would you recommend for an engine hauling trains of 40 to 65 air-braked cars? A.—About 50,000 cubic inches. In fact, advantage should be taken to put on 60,000, if possible. The pump will be operated easier, will heat less and deposit less moisture in the train pipe.

(147) C. J. C., Gordon, Pa., writes:

1. How can you release a brake that will not release by bleeding auxiliary after car has been cut away from engine and all air has gone out of trainpipe? A.—1. First look to see that levers are not fouled, hand brake set, or retaining valve turned up, then take oil plug out of the brake cylinder. 2. Why will this brake not release by bleeding the auxiliary reservoir at bleed-cock? A.—2. possibly the leakage groove is stopped up and the slide valve stays on its seat, because of strong spring on its back, or sticky oil. Any brake in good condition should release when bled.

(148) G. W. H., Streator, Ill., writes:

I am having some trouble with a 9-inch Westinghouse pump this last week; it will run fine for 10 or 12 miles, and then all of a sudden it will (break) commence to blow the same as if you were putting on the blower; it is the steam going to the exhaust, and it will act that way maybe a dozen times in 100 miles. I attribute the cause to be in the main valve, or a packing ring broke on the steam piston. Please say whether I am right, as the engines are pooled, and we do not get the same engineer more than once or twice a week. A.—First look for broken packing rings. Then observe whether the slide valve does not climb off its seat onto the ridge beside it in the bushing.

(149) C. J. C., Gordon, Pa., writes:

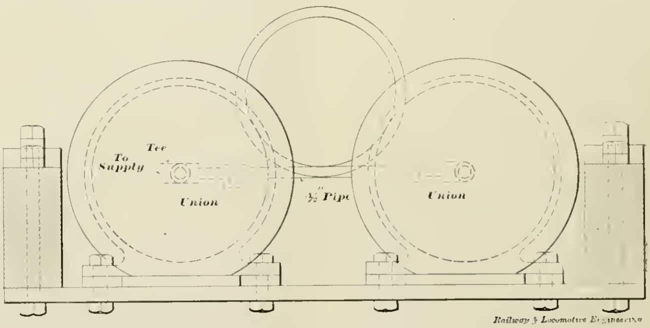
1. What pressure per square inch can you get in air-brake cylinders of a 4-car passenger train, fitted with Westinghouse quick-action brakes, after making a service application of 10 pounds with retainer set, then release and share up to 70 pounds, then go to full emergency? What pressure do you get in brake cylinders? A.—1. With pistons traveling about 5½ or 6 inches, the final pressure would be about 62 or 63 pounds. 2. Suppose (the same train) I charge up to 70 pounds train line (set retainers, and they hold 15 pounds in brake cylinders after making reduction of 10 pounds in train). I then recharge to 70 pounds train line, and make as large a reduction as will equalize train line brake cylinder and auxiliary reservoir. How much pressure will I get? A.—2. About 53 to 56 pounds.

(150) R. W. S., Princeton, Ind., writes:

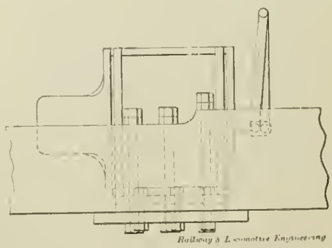
Referring to your published description and illustration of the Automatic Double-Heading Feed-Valve device on page 81. Now, as I see it, the device on the second engine is wide open to main reservoir pressure when brakes are released. The pump is recharging the main reservoir, and the pressure is rising on the under side of piston 7, and also in the train line and auxiliary reservoirs. These parts will soon be overcharged unless the check valve 41 is closed. How can the check valve 41, under the above conditions, be closed and not reset the brakes? A.—As stated in the description, valve 41 remains open until a reduction in the train line is made—then it closes. On long trains and heavy grades, where double and triple headers are used, and such a device is intended for, there is no danger from overcharged train line and auxiliary reservoirs. In the first place, reapplications follow releases too closely to allow very high train line pressures. In the second place, pressures above the 70 pounds standard would not be objectionable on heavy down grades if they could be obtained.

(151) G. K. H., Springfield, Mo., writes:

1. Does the New York brake give more pressure in the brake cylinder in emergency than in service? A.—1. No. It gives the same pressure in both service and emergency. 2. I understand the Westinghouse brake gives ten pounds more pressure in cylinder in emergency than in service. I have heard the same claim made for the New York brake and have heard it disputed. Which is right? A.—2. The Westinghouse gives about ten pounds more in emergency than in service, due to a portion of the train pipe pressure passing to the brake cylinder along with auxiliary reservoir pressure. The New York gets no train line pressure in the brake cylinder, auxiliary reservoir alone giving pressure to the brake cylinder in both service and emergency applications. The emergency is quicker than the service, but no higher in pressure. 3. If there is 10 pounds difference in the brake cylinder pressure in emergency with 7 inches travel with the two kinds of



NEW YORK CENTRAL TYPE OF "LOOP PIPING" FOR DRIVER BRAKES.



DRIVER BRAKE "LOOP" CONNECTION.

brakes, would there not be a different braking on two cars of the same weight? A.—3. Yes. 4. Or do the New York Co. make up this difference in the levers? A.—4. No. 5. The New York Instruction Book, in explaining leverage, gives the value of an 8-inch cylinder as 3,000 pounds. A.—5. Probably the instruction book you have is an old one, printed before the New York Co. was restrained by the courts from venting train pipe pressure to the brake cylinder in emergency applications. 6. On a car with a New York triple valve where the levers are figured at 70 per cent. of the light weight of the car, and the false figure of 3,000 pounds is used, what is the actual braking power on the car? A.—6. About what a 50 or 52 pound piston pressure would give. We would have to know the measurement of the levers to give the actual braking power of the car.

Too Cold or Too Hot.

A railroad man talking recently about the difficulty of keeping an endurable temperature in cars while moving perishable produce said:

This winter we had two refrigerator cars arrive here from Florida with oranges and the heat in the cars when they arrived here was over 120 degrees and the oranges were nearly baked, and the thermometer here in Buffalo was below zero. My explanation of that is that in Florida, at the time those oranges were loaded, it must have been a very hot day, possibly at noon; the doors of the car stood open and accumulated that degree of heat, and after the oranges were put in it was shut up tight in order to make it safe to come to Buffalo, and the result was that they were packed practically in an oven and the oranges nearly ruined; they saved a few boxes out of the 296. When we are drawing fruit from a southern climate north in the winter, the ventilation has to be regulated so as to let the cold air in down there and shut the cold air out up here.

Another experience with bananas last season: Some refrigerator cars came from Baltimore with bananas with the ice doors open, in refrigerator cars; some one en route closed the ice doors; when they got here the bananas were baked; the thermometer stood 148 degrees inside of one of those cars. We are just settling the claim now. The man wants pay for the bananas and we couldn't get enough out of them to pay the freight.

The American Westinghouse Company has under contemplation the building of an electric road between Rome and Naples, a distance of about 120 miles. They guarantee to cover the distance in two and a quarter hours. The journey at present requires six hours to make it.

Fired With Rubber Balls.

"Well, young fellow," said old Levi, "you probably did not live in the days when car springs were made of solid balls of rubber. It was before French, of Pittsburg, began to make decent springs of steel, and I guess all the car builders thought rubber was the only thing to use. Them balls were corkers, sure. They'd make the cars bounce over the joints like a girl jumping a rope. Often they would get loose and fall off, and the boys used to steal them and make rubber balls for the school games. One day when I was running the wreck train we were called to B—— on account of a collision. We arrived there and were at work trying to clear the track when another train came up and ran into our caboose, so that we were blocked between two wrecks. The worst part of it all was that we ran out of wood, and as cord wood was the material used exclusively for firing then we could not find any of it and as I had instructions to keep my engine alive I determined to do so at all hazards.

"I hunted around for pieces of the wreck, but they were scarce. There was one car loaded with old gum springs which were being sent to the factory, and my fireman, Jim Williams, collected about 20 of them and dumped them into the furnace of the old Norris, much against my will, as I did not know what the results might be.

"After a while the gum commenced to melt and burn, and you ought to have seen the fire it made. The draft sucked the melted rubber into the flues and the old pot was fire from the firebox door to the top of her stack, and she stunk worse than a thousand polecats. She commenced blowing off like fury, and the gage hugged the 130 mark for three hours. I was afraid she'd blow up, but she didn't, and we did good work with her at the wreck.

"I think that I am the only engineer that ever ran an engine fired with rubber balls."—*Pittsburg Post.*

The famous Empire State Express on the New York Central went through a unique experience in the floods last month. On the Hudson River division the train became stalled in the swollen Hudson, and the passengers had to be taken off in boats. That and several other trains lay soaking in the water for nearly a week.

Some curious questions come to this office to be answered. Among this month's contributions was one which said: "Suppose you were putting a new firebox into a boiler and found that you could not put in the braces until the firebox was in, and when the firebox was in, you found that there was no room to reach the braces, what would you do?" The answer is still under consideration.

Adjust Slide Valves.

EXPENSE OF MISTAKES. FOURTH PAPER TO ADJUST SLIDE VALVES.

BY F. P. ROESCH.

Another report we frequently meet with is "Square Valves." Where eccentrics are not keyed on and engine must be pinched, it is quite an expensive proposition to square a set of valves, especially on one of the modern large engines. A machinist with two or more helpers being sometimes all day on the job at a cost to the company of from $8 to $10. Let us see if we cannot effect a saving here.

If the engine goes lame, listen to the exhausts and note position of cross head when the different exhausts take place. Learn to locate where your troubles exist so as to report them correctly. It may save several hours hard work in the round house.

For instance, should your engine develop two loud or two light exhausts, thus ——— —— ——— ——. Notice position of cross head when abnormal exhausts take place, to locate defective side. You should be familiar enough with your engine to know which exhausts are normal and which are not.

There are quite a number of defects that will cause an engine to "go lame," but we will only speak of the more frequent ones, things which are of common occurrence, and liable to happen at any time.

If the engine starts lame, as explained above, two loud and two light exhausts, you can generally look for a broken link lifter, a slipped eccentric, a loose rocker arm-pin—either top or bottom—a loose rocker box, or the nuts working off an eccentric strap bolt, allowing the strap to work open.

Should your engine start to hop along on three legs, so to speak, or develop our extra loud exhaust, look for a slipped blade, blade pin working out, or cut, or key in valve rod where it joins yoke working up.

When you notice anything going wrong with your valve gear it is a good plan to stop and look for the defect. A dry valve will cause an engine to go lame, but any *engineer* should be able to locate and correct that. If upon inspection everything appears intact, start up slowly with lever in corner, if engine sounds O. K. in corner hook her up. Now if you have two loud and two high exhausts you can generally figure on your back-up eccentrics being slipped. If the engine goes on three legs when hooked up, but is square in corner, it is a back-up blade that is slipped—the engine of course is supposed to be working in forward motion—to find which side the fault is on watch the cross head. You can do all this from right side. The exhausts from right cylinder take place, as right cross head is approaching ends

of stroke, consequently exhausts from left cylinder must take place when right cross head is about center of guides; therefore if the exhausts are normal with right cross head at either end of guides, the trouble is on left side, and if the normal exhausts take place with right cross head about center of guides, it is the right side that is at fault. Now if by noting as above you find a blade is slipped, you can easily adjust it by noting position of cross head when loud exhaust takes place and moving the blade toward it. Thus, if loud exhaust takes place with cross head at forward end of guides, lengthen the blade, and vice versa. This does not apply to a direct engine. A back-up eccentric is generally hard to get at, and if engine is not too lame it is best to go on without stopping to fool with it, as you would doubtless need to have it set exactly right anyway when you get in.

Now here is where you can avoid the expense of a mistake and save the company a few dollars. A little thought and practice will enable any engineer to tell whether it is a blade or eccentric that is slipped, which one it is, and which way, and on arrival, instead of reporting "Square Valves," which would require going over the entire engine, you can just report, "Set left back-up eccentric," or "Equalize blades, right side, go-ahead blade is slipped." In this way round house men know just where to begin, and can often do in one hour what would otherwise take the major part of a day when covered by the indefinite report of "Square Valves."

We will pass to injectors.

If your injectors go back on you and you have tried everything you know to make them work, don't make a report on arrival, "Overhaul right injector." Give the repair man some idea of what is wrong. You can say, "Injector won't prime," or "won't lift all the water," or "it breaks when running," etc. The trouble may be but some little thing that you are "not on to"; something that he may be able to fix in 10 minutes, while it would take hours to overhaul the injector. Time is money in the round house same as elsewhere.

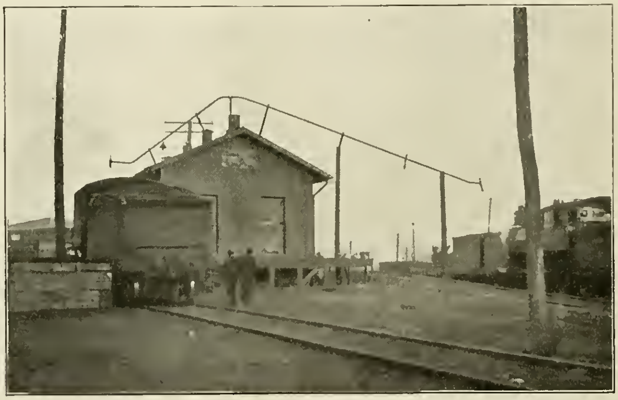
The same applies to your air equipment.

Don't say "overhaul pump," or "brake valve" or "governor," etc., try to locate the trouble and specify it.

I recall a case where an engineer with a new E. 6 brake valve reported "Clean engineer's brake valve and adjust governors," three trips in succession. Each time after valve was cleaned both it and governor were mounted on testing rack in back shop, and there adjusted, but still the trouble continued. The engineer's complaint being that he could not get any excess pressure, in fact when questioned as to symptoms of his valve and governors he said, "that most of the time his reservoir pressure did not even equal his train line." Had he but given it a thought he would have seen that this is an impossibility and he would have located his trouble where it really existed, in the gage.

Had he located his trouble correctly at first, he would have saved the company $12.50.

This article on the little mistakes of engineers in reporting and locating defects, and their attendant expense, could be carried out indefinitely, but there is no need of it. All I wish to do is to impress upon you the necessity of care and judgment in reporting and diagnosing the diseases of your engines. It is not hard to do, if you will only set your mind to it. And when you do master it in all its details, so as to be able to say just what is wrong with your engine every time the round house foreman will rise up and call you blessed.



SAND HOUSE AND CONVEYING PIPES AT THE 58TH STREET ROUNDHOUSE OF BALTIMORE & OHIO R.R., PHILADELPHIA, PA.

New Smoke-Consuming Device.

A smoke consuming device—one which actually consumes the smoke gases and thereby contributes to greater heating and steam supply, instead of killing the smoke and the steam, too, has been recently invented, and is now in successful test on two locomotives of the New York Central.

The scheme and foundation principles are simple. In addition to the usual brick arch, extending back and upward from below the boiler tubes, another similar arch, of shorter length, projects forward on a level several inches above the top of the fire-door opening. Through the boiler-head, into the firebox, on a line a few inches above the short, level back arch, project a series of six or eight two-inch pipes, equally spaced, about 12 or 14 inches long. Through these tubes, that portion of the firebox above the brick arches, is supplied with atmospheric air which mingles with the smoke gases and form a perfect combustion, eliminating all smoke. The air is introduced through the pipes to the firebox in a heated condition, thus preventing the chilling effect on the firebox parts. The boiler head is covered with a sheet steel casing, with openings at the upper edges, through which air may enter and be heated by passing over the boiler head surface en route through the pipes to the firebox. The exhaust of the engine when running will draw in sufficient atmospheric air through the casing and pipes to provide sufficient air to combine with the firebox gases and consume the smoke. When the exhaust ceases, due to the engine not using steam, compressed air is supplied to the pipes, thence to the firebox, with the same results.

The two great achievements of the device are that smoke is entirely eliminated and the engine becomes a freer "steamer." This should satisfy the most exacting requirements of a successful "smoke burner."

The American Brake Shoe and Foundry Company, 26 Cortlandt street, New York city, has assumed control of the brake shoe output of the plants of the Sargent Skeleton Steel, the Diamond "S," the Skeleton Steel Insert, the Lappin Steel Back, the Streeter Steel Back, the Corning and the Ross-Meehan. Hereafter the agents of the constituent companies will represent the combined interests.

The Buffalo Forge Company, Buffalo, N. Y., are naturally quite pleased with the recommendation which Mr. William Garstang, the well-known superintendent of the "Big Four" railroad, gives their down draft forges. Those in question have been in service since 1895, and are still giving excellent service. The freedom from overhead pipes and the absence of smoke make the down draft forges very desirable.

Of Personal Interest.

Mr. C. Skinner has been appointed master mechanic of the Chicago and Alton at Slater, Mo.

Mr. R. L. Doolittle has been appointed foreman of Chattanooga Division of Central Railroad of Georgia, at Chattanooga.

Mr. Charles S. Clarke has been appointed general manager of the Mobile & Ohio, with headquarters in St. Louis, Mo.

Mr. S. W. Crawford has been appointed master mechanic of the shops of the Chicago and South Eastern at Muncie, Ind.

Mr. W. M. McCampbell has been appointed master mechanic of the East Louisiana Railway, with office at Florenville, La.

Mr. W. A. Garrett has been appointed general superintendent of the Philadelphia & Reading—vice Mr. W. G. Besler, resigned.

Mr. J. G. Schreuder has been appointed assistant general manager and chief engineer of The Union Switch & Signal Company.

Mr. G. A. Goodell has been appointed general superintendent of the Chicago Great Western, vice Mr. Tracy Lyon, promoted.

Mr. C. M. Hunt has been appointed superintendent of the St. Louis and Memphis Railroad with office at Caruthersville, Mo.

Mr. Wm. Donahue has been appointed traveling engineer on Minnesota & Iowa & Nebraska division, vice Chas. Cartwright, deceased.

Mr. John Forster, general foreman of the St. Louis & San Francisco at Kansas City, Mo., has been promoted to master mechanic at Kansas City.

W. E. Chester, master mechanic of Central Railroad at Savannah, Ga., has been transferred to Macon shops of same road as master mechanic.

Mr. Frank Dillinger has been appointed superintendent of the Chapleau division of the Canadian Pacific, with headquarters at Chapleau, Ont.

Mr. V. B. Lang has been appointed master mechanic of the Alabama Great Southern, with office at Birmingham, Ala., vice W. N. Cox, resigned.

Mr. Hugh Montgomery has been appointed general foreman of the Central Railroad of New Jersey, at Fiddlers, N. J., vice Mr. George Thompson, resigned.

Mr. W. W. Richard has been appointed master mechanic of the Cananea Consolidated Copper Co.'s railways, with headquarters at La Cananea, Sonora, Mex.

Mr. W. D. Lee has been appointed superintendent of the Rio Grande Southern, with headquarters at Ridgway, Col. He was formerly with the Denver and Rio Grande.

Mr. Ernest Messimer has been appointed master mechanic of the Cincinnati, Richmond and Muncie at Richmond, Ind. He was formerly with the Lake Erie and Western.

Mr. John T. Jones has been appointed round-house foreman of the Central Railroad of New Jersey, at E. 22d street, Jersey City, vice Gilbert H. Hutchinson, assigned to other duties.

Mr. C. H. Ackert has been appointed general manager of all lines of the Southern Railway except the St. Louis-Louisville lines, with headquarters at Pennsylvania avenue, Washington, D. C.

Mr. Frank Walters is appointed superintendent of the Main Line of the Burlington, Cedar Rapids & Northern and its branches south of Iowa Falls, to succeed Mr. George A. Goodell, resigned.

Mr. Gilbert H. Hutchinson has been appointed road foreman of engines of the Central Railroad of New Jersey, with headquarters at Jersey City, vice Mr. Hugh Montgomery, assigned to other duties.

Mr. W. G. Besler has been appointed general manager of the Central Railroad Company of New Jersey. The operating, engineering and roadway departments will report to him and be subject to his orders.

Mr. Ira C. Hubbell, president and treasurer of the Locomotive Appliance Company of Chicago, has been appointed buyer for the Kansas City, Mexico and Orient Railway and the Interstate Construction Company.

Mr. W. D. Sargent, president of the Sargent Company, has moved to New York in connection with the new consolidation which is called the American Brake Shoe and Foundry Company. His office is at 26 Cortlandt street.

Mr. Tracy Lyon has been appointed assistant general manager of the Chicago and Great Western Railway. Mr. Lyon entered the service of the company five years ago as superintendent of motive power and his advancement has been rapid.

The headquarters of Mr. S. D. Hutchins, district traveling inspector for the Westinghouse Air Brake Co., has been changed from Buffalo, N. Y., to Columbus, O. The "genial Sam" may be hereafter found at 303, M. & M. Building, that city.

Mr. William C. Ennis is appointed master mechanic of the Central New England Railroad, with office at Hartford—vice A. B. Phillips resigned. Mr. Ennis was long master mechanic of the New York, Susquehanna & Western and is well known.

Mr. Garry R. Sanborn, at present superintendent of the Sioux City division of the Chicago & North Western Railway will succeed Mr. W. D. Cantillon as superintendent of the Minnesota & Dakota division of the same road at Winona, Minn.

Mr. E. G. Owens has been appointed chief train dispatcher of the Baltimore & Ohio, with jurisdiction over the Cincinnati, Washington, Louisville and St. Louis districts, vice Mr. J. M. Mack, transferred; Mr. C. G. Stevens appointed night chief dispatcher, vice E. G. Owens, promoted.

Mr. A. J. Love is appointed assistant superintendent of the Alabama Great Southern Railroad, vice Mr. Chas. E. Rickey, assigned to other duties. Mr. Love, who contributes an article on signaling to this issue of RAILWAY AND LOCOMOTIVE ENGINEERING, was formerly train master at Chattanooga.

Mr. W. J. McQueen has been appointed assistant master mechanic of the New York Central Railroad, with headquarters at Mott Haven, N. Y. Mr. McQueen has been for years engineer of one of the fast express engines running between New York and Albany. He was known for his record in keeping trains on time.

Mr. Frank P. Sargent, grand master of the Brotherhood of Locomotive Firemen, has been offered the position of commissioner-general of immigration by President Roosevelt. Mr. Sargent has the offer under consideration and is likely to accept it. His appointment will be a great loss to the Brotherhood of Locomotive Firemen, with whom he is exceedingly popular.

Mr. A. J. Haaser has been appointed machinist in charge of the new Steel Floating Dry Dock at the United States Naval Station, New Orleans, La. He was formerly foreman of the Southern Pacific Company's machine shop at Algiers, where he has been for the past eight years.

Mr. C. H. Hogan, master mechanic of the New York Central at Depew, has been appointed to a similar position on the West Shore Railroad, with headquarters at New Durham, N. J. Mr. Hogan was celebrated when he was an engineer for making some of the fastest runs accomplished on the New York Central Railroad.

Announcement has been made of the appointment of Mr. W. D. Cantillon to be assistant general superintendent of the Chicago & Northwestern Railroad, with headquarters in Chicago. The position is newly created. Mr. Cantillon has been superintendent of the Minnesota & Dakota division, with headquarters at Winona, Minn., and was formerly assistant superintendent of the Wisconsin division.

Mr. W. F. Buck has been appointed master mechanic of the Rocky Mountain Division of North Pacific, vice Mr. F. P. Barnes, who, we understand, has been appointed assistant superindent motive power of Santa Fé system. Mr. Buck has worked his way up through the ranks—was a fireman and engineer on the Intercolonial, then learned the machinist trade at Moncton, N. B. He has been with the Nothern Pacific several years as foreman of shops.

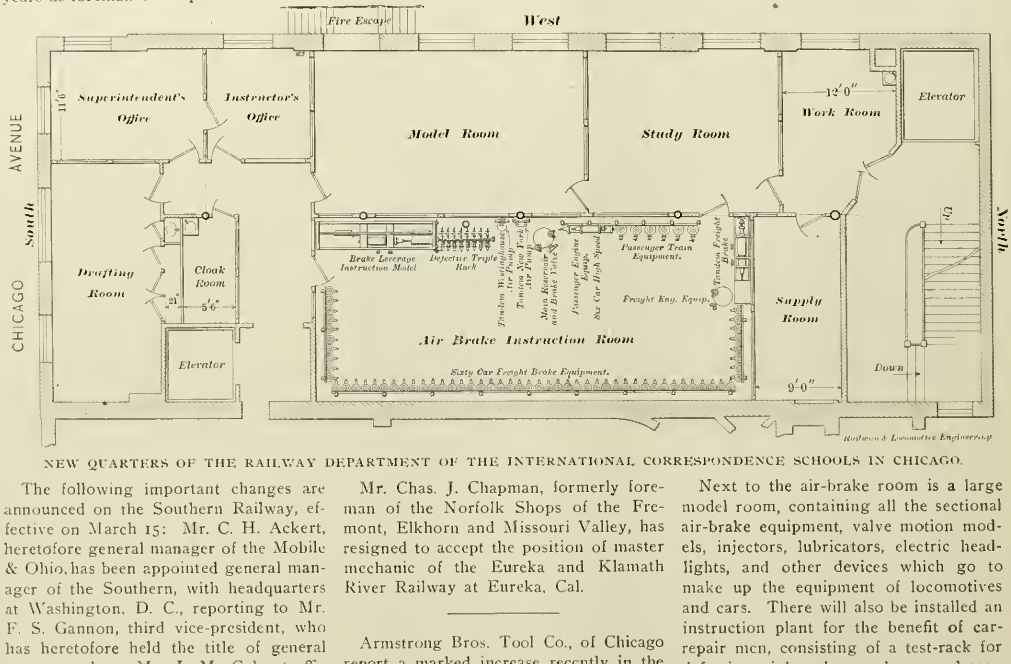
traffic manager, with office at Louisville, to succeed Mr. Powell, promoted. Mr. Ackert, the new general manager, has been general manager of the Mobile & Ohio since May 1, 1891, and previous to that date was president and general manager of the Elgin Joliet & Eastern and Chicago Lake Shore & Eastern. Mr. Culp has been with the Southern and its predecessor, the Richmond & Danville, since September 1, 1891. He was assistant traffic manager of the Richmond & Danville until June 30, 1894, when he was appointed traffic manager of the Southern, and was formerly general freight agent of the Louisville & Nashville. Mr. Turk was formerly for many years general passenger agent of the Southern and the Richmond & Danville, and has been assistant passenger traffic manager since January 1, 1901. Mr. Powell was formerly general freight agent of the Southern, and has been assistant freight traffic manager at Louisville since July 1, 1899

New Quarters of Correspondence Schools.

The officers of the Railway Department of the International Correspondence Schools of Scranton, Pa., which have been located in the Manhattan Building at 315 Dearborn street, Chicago, have been moved to new quarters in the new Bush Temple of Music, on the corner of North Clark street and Chicago avenue, Chicago.

Both the offices and the instruction plant will be located on the fourth floor. The offices, with 2,500 feet of floor space, being on the east or Clark street side of the building—the instruction plant having 3,000 feet on the west side.

The operating air-brake room, 54 feet long by 19 feet wide, contains the sixty-car freight train; the six-car, high-speed passenger train; the ten-car air-signal equipment; the two locomotive brake equipments and all the tandem apparatus.



NEW QUARTERS OF THE RAILWAY DEPARTMENT OF THE INTERNATIONAL CORRESPONDENCE SCHOOLS IN CHICAGO.

The following important changes are announced on the Southern Railway, effective on March 15: Mr. C. H. Ackert, heretofore general manager of the Mobile & Ohio, has been appointed general manager of the Southern, with headquarters at Washington, D. C., reporting to Mr. F. S. Gannon, third vice-president, who has heretofore held the title of general manager also. Mr. J. M. Culp, traffic manager, has been appointed fourth vice-president, in charge of traffic, reporting to Mr. W. W. Finley, second vice-president, and the office of traffic manager has been abolished. Mr. T. C. Powell, assistant freight traffic manager at Louisville, Ky., has been appointed freight traffic manager, with headquarters at Washington, D. C., and Mr. W. A. Turk, assistant passenger traffic manager, has been appointed passenger traffic manager, with headquarters at Washington, and the office of assistant passenger traffic manager is abolished. Mr. Lee McClung, assistant to the second vice-president, has been appointed assistant freight

Mr. Chas. J. Chapman, formerly foreman of the Norfolk Shops of the Fremont, Elkhorn and Missouri Valley, has resigned to accept the position of master mechanic of the Eureka and Klamath River Railway at Eureka, Cal.

Armstrong Bros. Tool Co., of Chicago report a marked increase recently in the export demand for their tool holders. They have recently established agencies in Australia and New Zealand, which give every promise of developing into important markets for the company's product. Some time ago the company sent Mr. Nestor Johnson into Norway, Sweden and Denmark, to investigate that market and to introduce the Armstrong tools, where he met with the most gratifying success. He has recently returned to Chicago, after placing the Armstrong agency for the countries of Norway, Sweden and Denmark with the firm of C. S. Christensen, of Christiana, Norway.

Next to the air-brake room is a large model room, containing all the sectional air-brake equipment, valve motion models, injectors, lubricators, electric headlights, and other devices which go to make up the equipment of locomotives and cars. There will also be installed an instruction plant for the benefit of car-repair men, consisting of a test-rack for defective triple valves, a leverage lesson and apparatus for showing how to clean brake cylinders, piston packing and triple valves.

There are several study rooms and a reference library for the students, a drafting room and offices for the instructors—the floor plan is illustrated in this issue.

No expense has been spared in making this the most complete institution of its kind anywhere. Students may go there and have the advantages of this plant in demonstrating just how the equipment operates on any length of train up to sixty cars, as well as have the services of competent instructors to explain the knotty points.

Ten-Wheel Passenger Locomotive for the Southern.

We illustrate with this a ten-wheel passenger engine recently built by the Baldwin Locomotive Works for the Southern Railway.

The engine has cylinders 20 x 26 inches, balanced slide valves and driving wheels 70 inches diameter. The boiler is of the wagon-top type, 62¼ inches diameter at the smallest ring and carries a working pressure of 200 pounds to the square inch. The firebox goes above the frames between the wheels and is 108⅜ inches long and 41⅞ inches wide. In front it is 73 inches deep and at the back 58¾ inches deep. There are 290 2-inch tubes, 14 feet 3½ inches long. The heating surface is 2,310.3 square feet, of which 2,157.5 square feet are in the tubes and 152.8 square feet in the firebox.

Engines of this kind are very popular for passenger train service on the Southern Railway, and make the time with heavy fast passenger trains more regularly than any form of engine the company have ever tried.

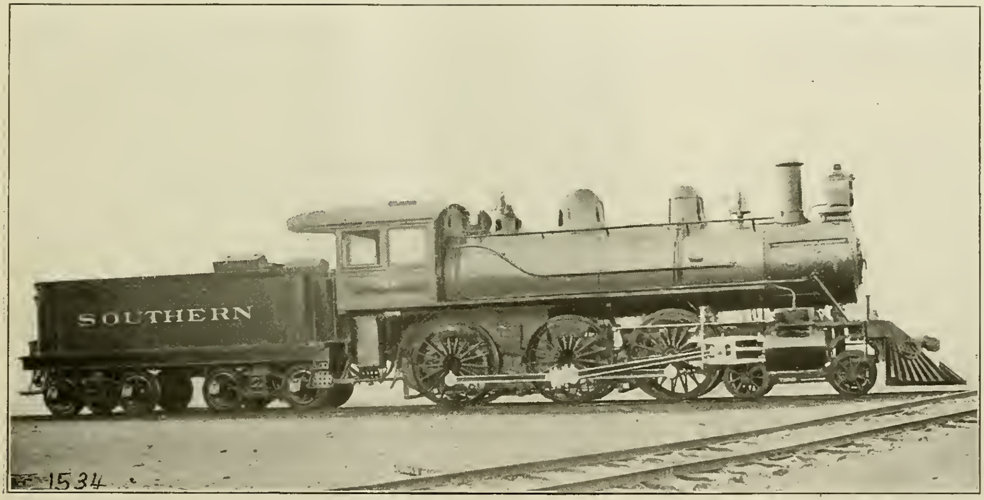
The restless spirit of Yankee activity is nowhere better shown than on our American railroads. The department of motive power and rolling stock is constantly enlarging and changing for betterment in engines and cars. The engineering department is forced to keep pace and consequently is obliged to lay heavier rails, put in stronger bridges, widen tunnels and enlarge shops and round-houses. Nor will one change suffice. The long-cherished standards are things of the past and but memories. No sooner is one improvement completed than another is projected. The old, which has perhaps seen a life of but a year or two, is relegated and a newer and greater improvement succeeds it. There is no finish. There is no end. Nothing but a restless striving for something better which will bring better results and increased profits. It is this spirit of constantly seeking something better and not being permanently satisfied with anything which has brought the American railroads to their present prominent position.

The Valve Motion That Promises to Save Forty Per Cent.

In the railway jottings from Mr. C. Rous-Marten, published elsewhere in this paper, some particulars are given of the improved valve gear under trial on the Great Northern Railway of England, which raised quite a furor on the other side owing to reports having been made that its use saved 40 per cent. of the fuel that would be required to do the work with ordinary locomotive valve gear. The new gear is merely an arrangement of valve motion that gives remarkably quick admission of steam and prompt release. The engineer who has been accustomed to studying the changes in steam distribution effected by improved valve gears would say that this one was likely to increase the work producing capacity of cylinders, but experience would incline them to doubt the merits of the invention as a means of saving fuel.

Inventions intended to admit steam to the cylinders of a locomotive as near to boiler pressure as possible, cut off promptly, hold on to the steam as long as possible during the period of expansion and then produce a sudden release, have been tried without number on our railroads. Great promises of their efficiency have been made concerning many of these inventions and in many cases they have been promoted and advocated by highly influential railroad men. Yet the best of them went to the scrap heap after their novelty had worn off, and their sustainers became weary of carrying the burden. There has been no decade in railroad history in the United States that failed to produce novelties of valve gear, whose purpose was to dispense with the D slide valve and the mechanism used for actuating it. The first line of reputed improvements were in the form of extra cut-off valves, and some of them were held in high favor for many years, and the only reason why they fell into desuetude was, that a plain single slide valve distributed the stream just as well, was elemental in design, was seldom out of order and cost little for repairs and maintenance.

But the plain slide valve had no special friends or advocates, and when a novel valve motion was invented, there was no great difficulty in making many railroad mechanical men believe that an improved valve motion was badly needed and they went through the experience of their predecessors and obtained by very costly lessons convincing evidence that the plain slide valve was hard to beat and that novel valves and gears that promised so much saving of steam failed utterly when subjected to the tests of every day train service. Inventions of this character and agitations in favor of profiting by them appear to have moved in cycles; and there is no reason to doubt that another period of experimenting with improved valves or valve gears may for a



BALDWIN TEN WHEELER FOR THE SOUTHERN.

time become epidemic among us without warning.

Those who are dissatisfied with existing valves and valve gearing are generally led to that condition through the study of indicator diagrams and through that part of the history of the steam engine which is illustrated by the indicator diagram. This informs them about the great waste of steam that was inseparable from the use of the plain slide valve with stationary and other engines and of the great revolution that was effected by the inventions of Sickles, Corliss, Allen, Meyer and other improvers of the steam engine. Indicator diagrams taken from a plain slide valve engine when compared with those taken from the improved engines seemed to tell a tale of reckless extravagance on the part of those who kept unimproved engines in use. When indicator diagrams taken from locomotives were compared with those taken from good forms of automatic engines, the student was frequently overwhelmed with indignation that the men responsible for the economical operation of locomotives should be so blind to the interests of the company they served. The student determined to change all that.. He would go forth into the wilderness of error and shout the gospel of improved valve gear.

The shouting was listened to by divers persons who could put faith into works, and they proceeded to devise a valve gear for locomotives that would produce an indicator diagram that resembled those taken from automatic engines. The most successful designer of such a valve gear was Mr. David Clark, Master Mechanic of the Lehigh Valley Railroad. There are illustrations in the Eighteenth Annual Report of the Master Mechanics' Association of a number of indicator diagrams taken from a ten-wheel engine equipped with Mr. Clark's valve gear. The gear entailed the use of six eccentrics and their connections, four rock shafts, two reverse levers, two additional valves and a variety of other extras, but the indicator diagrams were as fine as anything ever taken from a Corliss engine. The diagrams are ideal, and an examination of them almost re-fires dead enthusiasm concerning perfected valve motions, and brings back for a moment fleeting ideals that have long departed.

Another past master of the art of designing valve motions for locomotives that would produce a Corliss-like diagram was the late William Wilson, of the Chicago and Alton Railroad, whose valve gear will be found illustrated in the Twenty-third Report of the Master Mechanics' Association. We shared his enthusiasm for a perfected valve motion, we watched the development step by step of his ingenious labors to produce one, and we had the melancholy regret of helping to prove that the perfected valve motion, which produced diagrams such as no locomotive had ever made before, was a little more wasteful in the use of steam than the plain link motion actuated slide valves used on another engine of the same type, doing the same work. A highly perfected valve gear, so far as making indicator diagrams was concerned, was developed by the late A. J. Stevens, of the Southern Pacific Co., but there is no authentic record that it enabled a locomotive to do work with less steam than one equipped with the link motion and plain slide valve. The fine diagrams produced by the engines having Clark's valve, could be figured theoretically as indicating almost ideal steam distribution, but in practice the engines used as much coal and water to do a given measure of work as a link motion engine that produced an indicator diagram that resembled a leg of mutton. These facts are strange, but they are unquestionably true, and it is their teaching that makes us skeptical about the truth of the reports which credit the valve gear on trial on the Midland Railway with saving 40 per cent. of the steam as compared with a link motion plain slide valve engine doing similar work. American engineers have labored zealously and intelligently to produce a valve motion that would overcome the reputed defects of the link motion, but when the test has been performed the engines equipped with improved valve motion burn more fuel than those using the discredited link motion.

The Lake Shore people have a piece of track laid with steel ties which have received very close inspection since they were laid down. It was feared that severe frosty weather would make their bed so rigid that fracture would become common, but they have gone through the ordeal of an unusually severe winter very successfully.

The Panama Railroad.

BY E. W. GREGORY.

Owing to the recent prominence given to the Isthmus of Panama, perhaps your readers would like to learn something about the railroad that crosses that strip of land. Well, after a tempestuous voyage of nine days, the good ship "Finance" landed the writer at Colon, the eastern terminus of the Panama Railroad.

After presenting my credentials to Col. J. R. Shaler, the superintendent, I naturally wandered down to the mechanical end of the line. The first building I entered was the car shop, and you may imagine, I received a severe "jolt" at finding a large force of negro carpenters busily engaged in hammering together an attractive collection of—coffins. I backed out of there and entered the paint shop, where I found more negroes varnishing—more coffins, and I began to realize that every tie in the road represents a dead man.

NATIVE WOMEN WASHING CLOTHES—COLON.

The locomotive shops I found to be a more pleasant place—engines instead of coffins—and a very well equipped shop. They have a blast furnace, brass foundry, boiler shop, blacksmith shop with steam hammer, and lathes, planers, a wheel press, etc.

The railroad is single track, 47 miles long and 5 feet gage. It is one of the "crookedest" roads in the country and one of the hardest to learn, as it runs through a dense swamp, where each mile of scenery is precisely similar to the one you left behind. The rails are held together with lignum vitæ ties, which is the only wood that will stand the climate and is so hard, they have to bore a hole for every spike.

The train schedule provides four trains each way; two passenger and two freight, and the road is operated with 8-wheel American type 17" x 24" cylinders. They

have a bad hill, 10 miles long and 185 feet per mile, over which all freight trains are double-headed. The freight equipment has hand brakes, but the passenger coaches have air, with plain triples. The old "B, 11" brake valve is used and is secured to the side of the cab, which is a very handy place. The main reservoir is placed in the back part of the coal pit, and boarded over.

The engineer and conductor are the only white men on the train, the rest being Jamaica negroes, as are the switch engineers in Colon and Panama. The switchmen in the yards are mostly Spaniards.

Coal, of a very inferior quality has been found on the Isthmus, but the railroad is supplied with coal from Newport News, Va., and no one else uses any, as the cooking is all done out-doors on little charcoal pots.

The original telegraph poles were made in the form of a tall cement shaft, with a wooden stick running through the middle and out of the top, to support the insulators, but the damp climate swelled the wood and split the cement. They have been replaced with iron poles, but many of them are still standing, and their monumental appearance gives one the impression of running through a continuous graveyard, and I guess that's about right.

The rains in the tropics seem to contain a large percentage of grease, and the harder it comes down, the worse the rail gets. The only sand obtainable is very poor being mostly pulverized sea shells, and it is a regular thing in the rainy season to have to double the hill.

Most of the conductors are operators, and as many of the stations are supplied with instruments, he can raise the train dispatches and get orders in case of a delay. The rainy season, which lasts for ten months, consists of several very heavy showers during the day; not, as many suppose, a continual rain. But it makes things very damp, and it is a fact that you will find blue mold on your shoes and on the sweatband of your hat every morning. Vegetation is very rapid; a banana tree will produce a bunch of fruit in 6 months. The tree and all is cut down and another sprouts up and attains full growth in half a year. From 18 to 22 carloads of bananas are picked up on "steamer day," and sent to New York.

No trains are run after dark. The sun rises at 6 A.M., and sets at 6 P.M., all the year around, and there is only about 15 minutes twilight. The railroad follows the route of the Panama canal, and every few miles you meet large sheds full of locomotives; or huge, fully equipped machine shops, all going to decay for want of use. In fact, engines are so plenty, that when a negro canal engineer loses one over the end of a dump, they simply go and get another and fill in on top of the wreck. The canal engines are mostly 6-wheel, side tanks, French machines. Their boilers are fed by a vertical pump, situated in the right hand front corner of the cab, with a fly wheel buzzing around near the engineer's feet, and its exhaust pipe sticking out of the cab roof, which gives the engine the appearance of a tugboat puffing along. There are also a large number of Belgium and Rogers on the canal work, but these are stored away as the Frenchmen seem to prefer their own make.

It is also interesting from the canal point of view to note that great difference in tides at the two ends of the road. At Colon, on the Caribbean Sea, the tide rises and falls but 18 inches, while at

ENGINEERS QUARTERS—COLON.

COUNT DE LESSEPS' HOUSE—COLON

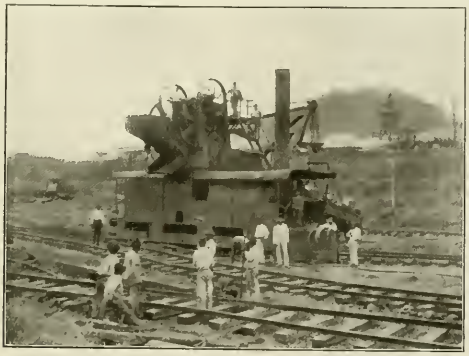
BEACH ROAD—COLON.

FRONT STREET-COLON.

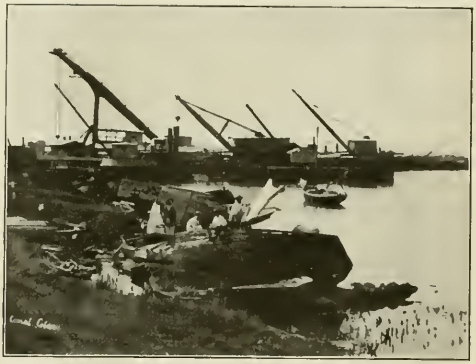
Panama, on the Pacific, the rise and fall is 22 feet. This is what makes locks necessary in the canal.

Most of the views explain themselves. That of the native women washing clothes will explain why clothes do not wear well in that region. They soap the clothes, lay them on a convenient rock (which may or may not be smooth), and pound them with a paddle. I may also add that they were dressed up for the occasion.

While I have endeavored to confine my notes to a description of the railroad, there is much to be told about the Isthmus. I could write of a country where pineapples line the roadside like weeds, and where bananas, oranges, cocoa-nuts, orchids (and alligators and boa-constrictors) flourish in an endless tangle. Of a part of the globe where the earth's crust is the thinnest, where earthquakes throw down bridges and open and close great fissures in the streets, of a land where the sun rises and sets in the same place—this being literally true, as a curve in the Isthmus makes Panama face south, so that the sun rises and sets in the Pacific. Where the arrival of the American steamer is hailed with as much joy as Christmas, and where railroad men earn their salaries by just staying there."



BELGIAN CANAL EXCAVATOR—CULEBRA, NEAR COLON.



CANAL DREDGES—FOX RIVER, NEAR COLON.

The Pennsylvania Railroad have recently erected on the Panhandle two water tanks which each hold 300,000 gallons of water. There has been scarcity of water during dry seasons in the district where the tanks have been put up, and it is expected that the big storage will provide the necessary supply between showers.

"The Story of Human Progress," is the name of an illustrated pamphlet published by the Goheen Mfg. Co., Canton, O. It gives, by means of beautiful engravings, a graphic history of the past and the present. We believe the work will be sent free on application by persons interested in paint and the protection of buildings from weather devastation.

Items from Editor's Note Book.

All real friends of humanity must be gratified with the rapid progress railroad companies are making in introducing pension systems for the benefit of their employees. Americans have been so sturdily independent that railroad men long regarded pension schemes as pertaining to pauperism; but most of them are now coming to regard pensions as the interest on money invested, which they really are. Many worn out railroad men who have gone through the painful ordeal of joining age and poverty would now be living in comfort, had the companies, in whose employ they exhausted their manhood, collected the funds that support a good pension system. I can see nothing pleasanter than to witness an old person watching the sunset of life in comfort and freed from all the cares of penury and harassment of wants.

There is one shadowed side to the picture with some old railroad men who have met compulsory retirement. They have been so much wedded to their occupation that it gave all the joy and pleasure of life that come to them. When their occupation was gone, their bonds with existence were severed. They had no new pastime to take the place of active duties, and to them slowly, slowly passed the melancholy day until they seemed to fall prematurely into the grave.

In the old countries where pensioning of old employees is so common, the men keep looking forward to the period when they will be their own masters, and most of them have anticipated engaging in pastimes and enjoyment that make retirement no hardship. I have known a great many railroad men who have led a very active life until the day they were retired, and they had made no provision for passing their period of enforced leisure with some kind of occupation or mental pastime. The consequence was that many strong, healthy men died of ennui and inanition in a few months. On the other hand, I was in the British Civil Service for six years, and during that time had many acquaintances whose time for retirement came to pass, and I do not remember one who fretted or suffered from being retired from actual service, and most of them seemed to take on a new lease of life after they were relieved from the cares of active service. A statistically inclined brother of mine, who is still in His Majesty's service, alleges that not more than ten per cent. of the men live to enjoy the pensions they have paid for; but the small remnant seems to me to be a vigorously robust fraction of the whole.

I was moved to begin writing about pensions through having lately learned about the pleasant way an old friend was lately retired. Everybody knows Calvin A. Smith, so long treasurer of the New York Railroad Club, and still longer Master Car Builder of the Union Tank Line. Mr. Smith has always been an active, vigorous worker, and withal a very progressive man, to which the cars developed under his charge bear witness.

One day, a few weeks ago, one of the principals of the company called Mr. Smith into his office, and told him that he had been working too hard, and it was time to take a rest. The outcome was that my old friend was promoted to be consulting superintendent of cars at his old salary. A private office was fitted up for his use and he was told to come to the office just when he felt like doing so. Under the new dispensation the old gentleman has enough to do to keep him from wearying, and he is enjoying himself. That I consider an ideal way to retire a man who has long borne the heat and burden of the day.

By an oversight we failed to give credit to *Railroad Men*, published by the Railroad Branch of the Young Men's Christian Association, New York, for the address by Mr. Andrew Carnegie published in our March issue.

Taking Down Rods on Both Sides.

One of the questions which never grow old is that of taking down side rods. When one side breaks down and has to be disconnected, is it necessary to take down other side? This is the form it usually takes, and as it is not easy to explain by words alone, we have made the accompanying illustration.

When the rods are up on both sides, one side is on the quarter, while the other is on center, and so force the wheels around in unison. Taking down the rods on the other side, however, and leaving them up on the side toward us, we find them as Fig. 1, showing a six-coupled engine on the lower quarter and moving in direction shown by arrows. When it reaches the center it is the position of Fig. 2, and here is where the chance for trouble creeps in. While it often—we might almost say usually—runs along all right, there are too many cases where the condition shown in Fig. 3 is found, and then rods or crank pins suffer.

With the rods on center there is nothing to force the wheels in either direction, as where the rods are up on the other side. The tendency is to continue turning, due to momentum of the engine, but the tendency does not always prevail.

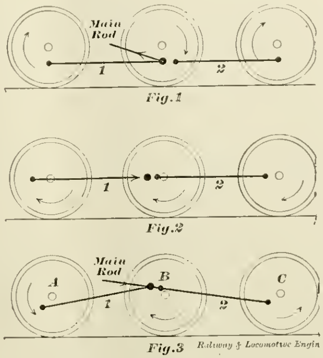
The main pin continues on its course, perhaps, while the forward wheel *A* and the rear wheel *C* hesitate, are forced in the other direction and the crank pins suffer. While it is not likely that both *A* and *C* would catch at the same time, it is well to show what *might* happen, and what can always be avoided by taking down all the side rods or the corresponding rods on both sides.

In the case shown, the side rods are coupled back of the pin, so that the back rods are not stiff but can kink up unless guided by the front rod. This means that should a front rod (1) break, it is of course necessary to take down the back rod (2) of that side. This leaves the condition shown in sketch, so that the rods on other side must come down also.

Should a back rod (2) on either side break, it is only necessary to take down the corresponding rod on the other side, leaving both front rods in place. This only in case the knuckle or joint is in the back rod.

Using this same reasoning on any number of coupled wheels and we find a general rule to be: Should a jointed rod break, take down the corresponding rod on the other side. If a solid rod breaks, the rod jointed to it must come down and so must the corresponding rods on the other side. In every case corresponding side rods on each side must come down. Only the main rod can be run one-sided.

The Burlington management expect to reduce the operating expenses of the company by not less than 25 per cent. within the next year. This will be brought about by a general reduction of grades and curves, by double tracking, and by increments to the power. The work of double tracking the system to the Missouri River has practically been completed. In the prosecution of the work nearly $3,000,000 has been spent and about $1,000,000 more will be necessary.



DISCONNECTING COUPLED RODS.

Centrifugal Separators.

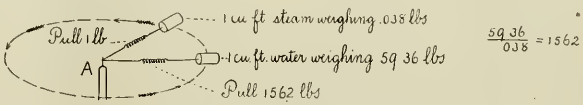
The B. F. Sturtevant Company, of Boston, have issued a little folder about their Exhaust Head, which contains such a novel illustration of the action of centrifugal force that we reproduce it.

Water weighs 1,562 times as much as steam, consequently the pull or tendency to fly away from the center is 1,562 times as much. This is why, in centrifugal separators, the water flies to the outer edge of the head and drains off, leaving the steam to escape practically dry. This relieves back pressure and avoids the annoyance of water from the exhaust dripping over roofs and sidewalks. If you have any doubts as to how centrifugal force affects things, study the cut and the figures.

of time he found out that there was great difficulty in making the springs employed on the traps hold their temper while kept continuously under water. He proceeded to question all the blacksmiths within a week's journey as to what they knew about tempering springs and did not learn anything. Then he went to the nearest library and read all there was to be found about the tempering of springs. Partly by the knowledge thus obtained and partly by original experiment, he succeeded in devising a method of tempering trap springs, so that they held the temper while under water.

"The making of springs became this blacksmith's hobby. Delving for information about the working of steel was his favorite amusement. In the course of time he became foreman of a railroad blacksmith shop, and then put his hobby into practical operation, to the end of making and tempering springs to carry with resiliance the load they had to bear. Before that time the formula of spring construction followed was: "make it strong neough to bear the heaviest load or severest shock, then double its strength for the sake of durability." The springs designed on that principle had about as little elasticity as an iron axle, and locomotives and cars rode so roughly that trainmen complained that the vibration shook their teeth loose.

"After a few years more, the blacksmith with the spring-making affinities, whose name was Aaron French, became the head of a spring-making establishment. One of his first transactions was to ask permission to put a set of springs under a car much used by the leading officials of the Pennsylvania Railroad. The springs he replaced weight 2,800 pounds, and those put in weighed 1,600 pounds. The officials were at first in-



AN EXAMPLE OF CENTRIFUGAL FORCE.

Aaron French.

Aaron French, the well-known spring maker, who has been in failing health for some months, died in his home in Pittsburg on March 24. The following notes by Angus Sinclair appeared several years in an article in the *Pall Mall Magazine* several years ago, and constitutes an obituary notice that reflects the greatest credit upon the subject of the sketch:

"Fifty years ago in the forests of Ohio, there was a very bright boy apprenticed to a blacksmith. This boy was fond of hunting and trapping. There were plenty of beavers, otters, muskrats (*Ondatra zibethicus*) and other water animals in the region where this young blacksmith was in the habit of trapping. In the course

credulous about the springs carrying the load safely, but a few trips in the car convinced them that they were mistaken, and the car rode so smoothly, that the springs for all the passenger equipment were gradually changed to conform to the expert's calculations.

"That was the beginning of the change which converted American railway rolling stock to the smoothest riding vehicles in the world. The soft-gliding parlor car, that rushes through space at sixty miles an hour without a harsh shock or jar, has been brought to its present perfection by a variety of adjusting devices, but the scientific design of springs has contributed more than all else to make it a marvel of easy riding."

Open Side Extension Planer for Locomotive Cylinders.

This planer is a modification of the regular Open Side Planer, made by the Detrick & Harvey Machine Co., Baltimore, Md., and is intended for planing the frame seats, saddle joints and steam chest seat on all sizes of locomotive cylinders between 20 and 36 inches.

The special end to be attained is to be able to plane the cylinders with the least possible chuckings. With suitable fixtures the cylinders are set on the table of planer with the valve face and steam chest seat in a vertical position. The head on the cross rail is used to plane the joint between the cylinders and also the exhaust nozzle seat. The head on the main post is arranged to plane the seat for the under side of frame, while the head on the special outside post is used to plane the valve seat is well as the steam chest seat and the seat for the top side of frame.

All of these planings that are in parallel lines can be done at the same time, while that for the ends of steam chest can be done by fitting the outside head with a power movement, up and down, and feeding the table for the cut. This vertical cutting has not been applied to any of these cylinder planers so far, but it is in contemplation as with it the planing of the cylinders can all be completed in one chucking.

The post upon which the outside head slides has a movement to and from the table so as to adapt it to plane cylinders of different sizes. In order to overcome any tendency of the table being lifted by the cut on high cylinders, the table can be gibbed down to the bed.

The outline drawing shows the position of the cylinder on the platen and the location of the surfaces to be finished. The following particulars as to dimensions of this planer may prove interesting.

The distance between main housings is 7 feet 3 inches, and under the cross rail 6 feet. The maximum size cylinder contemplated in this design is a 36 inch low pressure compound. The steam chest seat has a width of 36 inches, and the saddle joint 45 inches planing width. The frame seats are 4½ inches x 5 inches. The head on cross rail has 7 feet 3 inches horizontal movement and 1 foot 3 inches vertical adjustment which is by hand or power. The head on main housing for planing lower frame seat and center casting has 12 inches horizontal adjustment by hand, and 51 inches vertical adjustment by hand or power. On this head the tool post can swivel in a full circle. The head on intermediate housing for planing upper frame seat and steam chest seat has 8 inches horizontal adjustment by hand, and 36 inches vertical adjustment by hand or power.

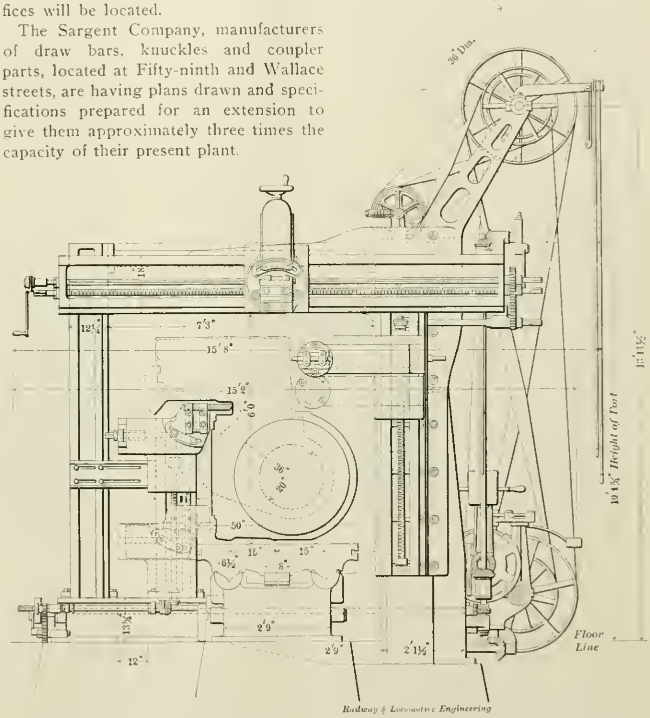
A tool of this kind will prove a money saver in any large railroad shop.

The Sargent Company of Chicago, heretofore operating an open hearth steel plant at Fifty-ninth street for the manufacture of draw bars, knuckles, coupler parts for repairs, and a plant at Chicago Heights, Ill., for the manufacture of Tropenas steel castings and steel and iron brake shoes, have transferred the plant at Chicago Heights, together with the classes of business done there, to The American Brake Shoe and Foundry Company, which company will hereafter conduct the business of this department from its offices at Chicago Heights. The Sargent Company will continue the operation of the open hearth steel plant at Fifty-ninth street, where its general offices will be located.

The Sargent Company, manufacturers of draw bars, knuckles and coupler parts, located at Fifty-ninth and Wallace streets, are having plans drawn and specifications prepared for an extension to give them approximately three times the capacity of their present plant.

To Improve Philadelphia Harbor.

The commercial interests of New York city have long been noted for the energy expended in maintaining the prestige of New York as the first shipping harbor of the Continent. All sorts of scheming, reputable and disreputable, have been followed to divert business to New York and to prevent its flowing into other natural channels. There is nothing that New York business men have hesitated to do in favor of their fine harbor, except to put their hands into their own pockets to help increase its natural advantages.



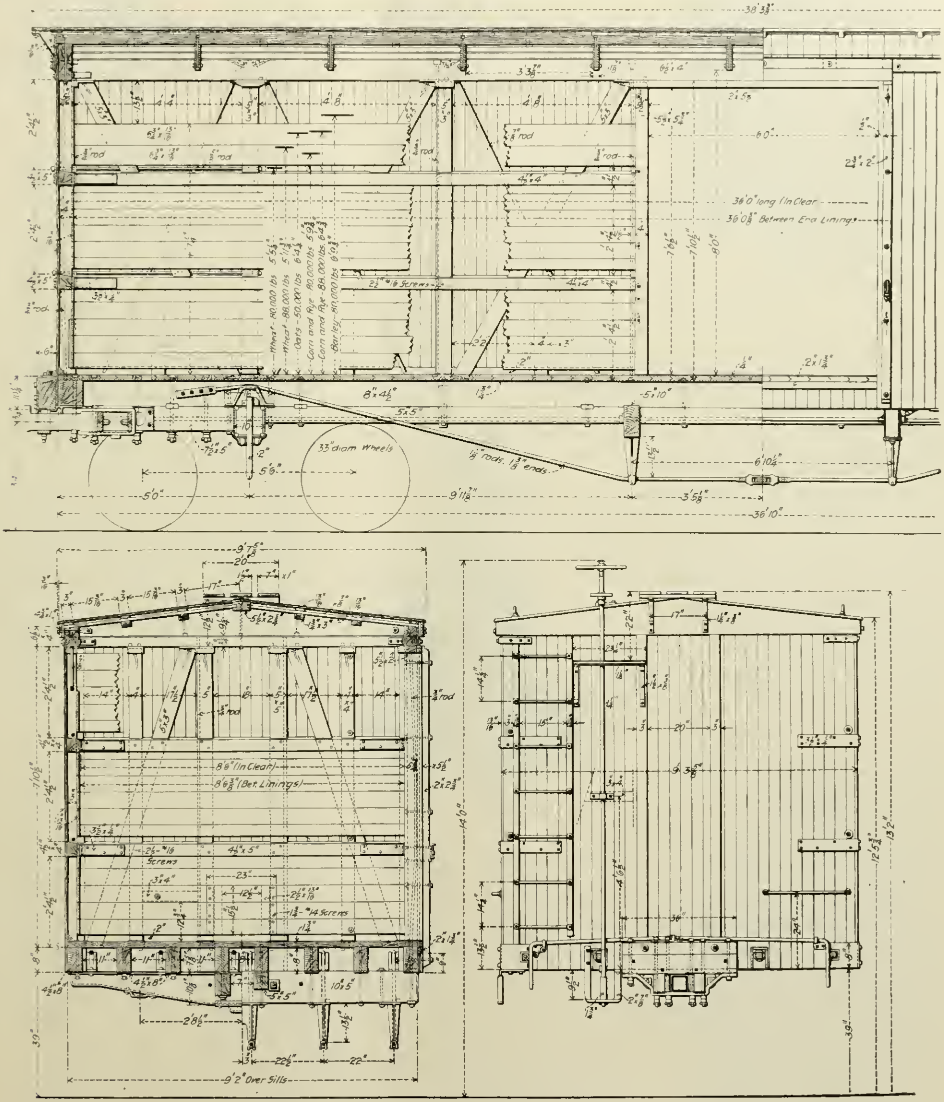
DETRICK & HARVEY CYLINDER PLANER.

The Chicago Pneumatic Tool Company has been so long located in the Monadnock Block that they have become pretty well identified with it, but owing to their requirements for greater office room, which they are unable to procure in that building, they have decided to remove to the Fisher Building, May 1. After May 1 they will be located on the tenth floor of the Fisher Building, corner of Dearborn & Van Buren streets, Chicago, where they will occupy very nearly the whole floor and will be glad to meet their friends whenever they can make it convenient to call. Their New York office will remain as heretofore at 95 Liberty street.

A new danger to the commerce of New York harbor has come up like lightning out of a clear sky, and the enemies of New York are calmly asking, what are you going to do about it? The government has made an appropriation of $600,000 to deepen the channel from Philadelphia to the sea, which will make the port of Philadelphia an important rival of New York. The change will be a great help to the Pennsylvania and the Baltimore and Ohio Railroads. Schemes are already in the air for new steamer lines to trade out of Philadelphia, and the backing of the Pennsylvania Railroad is certain to ensure the success of such enterprises.

New York Central Standard Box Car.

The problem which is to be solved by car designers is to provide a box car having the inside dimensions which have been adopted by the American Railway Association and having extreme outside dimensions within the clearance points of those roads over which the cars are to be operated and having a distribution of material suitable for the heavier capacities. For some roads the problem will not be a difficult one, because the allowable clearance dimensions will allow plenty of room outside of the dimensions prescribed by the American Railway Association for the use of almost any design, but those who are designing cars to be run on Eastern roads will need to make some close calculations. There are combinations of construction which, if accepted, will simplify the work. For instance, a steel underframe with drawbar passing through the end sill will allow a dropping of the body of the car, if the lower floor level will not be objectionable, so that no difficulty will be experienced with the design in the vicinity of the eaves. The chief difficulty is at the eaves. Some roads, however, while appreciating the advantages of the metal under-frame, think that the present difference in cost between the wood and the metal constructions does not warrant the use of the latter. There seems to be greater objection to passing the drawbar through the wooden end sill than there is to passing it through the steel end sill; therefore in the wood design it is considered best to place the drawbar beneath the sills; this keeps the floor the usual height, but considerable "shaving" is required to keep the eaves within the clearances. If the drawbar is passed through the end sill, the space for body bolsters and for truck bolsters is reduced, and considerable ingenuity will be required to get these bol-



DETAILS OF NEW YORK CENTRAL BOX CAR.

sters a proper depth to carry the heavier loads, even though it may be decided to carry the load on the side bearings instead of on the center plates.

There is shown in the illustration the box car, class "F-8," of the New York Central & Hudson River Railroad Company, and an examination will show the very satisfactory manner in which the problem has been solved for wooden construction, in the office of Mr. A. M. Waitt, superintendent of motive power and rolling stock. The car is designed for a capacity of 80,000 pounds rating. The designs of a box car of this capacity in pounds were just completed at the time the American Railway Association announced the inside dimensions which had been agreed upon by that association, and the design was changed to that shown to fulfill the dimensions of the association.

The design permits the use of a body bolster of such depth, 10⅛ inches, as has been proven ample for cars of 80,000 pounds capacity, and space has been left for a truck of either the pressed steel or of the arch-bar type, although the former will be used; the latter having a bolster of sufficient depth to carry the rating. A 6-foot door opening is provided, and with such width opening it did not seem desirable to put in more than the usual number of side posts, because the bracing would be too nearly vertical. The cross-tie timbers are placed directly beneath the door posts for better support to the door posts. The door fixtures are those of the "Security" car door. No shield is provided for the door track; there are many cars in service which have no shield, and because the clearances would allow only a very thin metal one, it was considered that there was no reason why the shield should not be left off. The upper joint between door and body of car is water-tight without a shield. Cast-iron pockets are provided at both ends of all posts and braces. Instead of tie-rods from plate to plate, joint bolts secure carlines and plates, and there is some saving of weight on this account. The Winslow Improved roof, as furnished by the Chicago-Cleveland Car Roof Company, is shown. The roof boards do not have quite as much slope as do the roof boards on cars previously built for this road, but the present roof has a greater pitch than the roof proposed by the committee of the Master Car Builders' Association. The pitch of the roof was decreased so as to give a minimum clearance between running board and overhead obstructions of 20 inches.

With the following unimportant differences the outside dimensions of this car meet the requirements of the circular of December 2, 1901, on "Outside Dimensions of Box Cars," issued by the Master Car Builders' Association:

	M.C.B. ft. in.	N.Y.C. ft. in.
Top of rail to upper face of floor..........................	4 0	4 ¾
Width of eaves at height of 12 ft. 6¾ in..............	9 7⅝	9 7⅝

The design requires the use of malleable iron draft arms; the experience on the road with many thousands in use being that none of these have been broken.

A Handy Planer Tool.

Leveling work on a planer isn't always an easy job, with the usual collection of blocks, pieces of iron, brass or tin, and other junk too often used. The time it takes counts up in a year, too, and would buy a number of the little tools shown.

This is the new planer jack made by Armstrong Bros' Tool Co., Chicago, Ill., which is a neat and inexpensive little device that will save its cost many times over. They are made in four sizes to meet varying requirements.

A Wise Policy.

The most unpleasant feature of changing the motive power on elevated roads from steam to electricity is the disposition of the men on the engines. In the

ARMSTRONG PLANER JACK.

improved service and lower cost of operation of electrically equipped trains, sight is generally lost of the engineer's and fireman's interest. Usually the engineer is made motorman at reduced wages and the fireman has to look elsewhere for work. A happy solution of this problem has been made by the Manhattan Elevated in New York, which has just begun to change form steam power to electric. The engineers are all made motormen at regular engineer's wages. Firemen are temporarily employed in various capacities at regular wages until there is an opening for more motormen, then the oldest ex-fireman is advanced in the usual way as in steam engine service The result is that the Manhattan will retain all its old, reliable men, and not be encumbered with the flotsam and jetsam which too often flock on the scene to take the old men's places and work for lower wages.

Automatic Bolt and Nut Machinery.

The two machines shown are the latest products of the Acme Machinery Company, Ceveland, Ohio, and all who understand the difficulties in the way of automatic machinery of this kind will appreciate the ingenuity displayed in their design and construction.

The working mechanism of the bolt cutter, except for feeding, is enclosed in the box bed, the latter being outside for the convenience of the operator. Threading is accomplished by two vertical, gear driven spindles, which are guided by lead screws running in split nuts. These spindles are reversed at the proper time by a shifting belt, and the dies back off at double the cutting speed, two bolts being cut at each operation.

The bolts are placed in the hopper at top of machine and are automatically arranged in a run way for each threading spindle, hanging by their heads as they are fed down into the machine. From these they are pushed into the vises which close automatically after bolts have centered themselves over die heads. The feeding mechanism then recedes and takes the next two bolts, which are brought forward just in time to eject the bolts after threading.

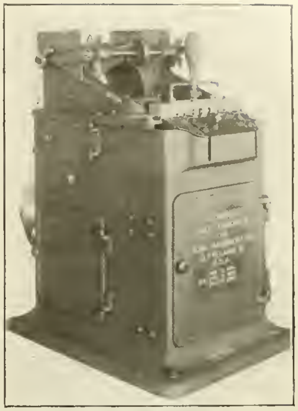
In case a ragged bolt or piece of scrap gets in the way, the mechanism throws itself out of gear so far as that particular runway is concerned, and prevents breakage or damage. There is also a relief in connection with the split nuts so that a crooked bolt stops the advance of the die-head spindle and thus avoids all breakage. As soon as the defective bolt has been forced out or taken out by the attendant, the machine goes on as before.

The machine will handle anything from $\frac{5}{16}$ to $\frac{1}{2}$-inch bolts by 4 inches long and with any heads except "T," as these drop through the slots. One man will attend ten machines, and each turn out 8,000 $\frac{3}{8}$-bolts in 10 hours.

The nut tapping machine is equally ingenious and somewhat similar in design. There are four tapping spindles in this case, each with lead screws (the Acme idea in staybolt cutter it will be remembered), to insure perfect threads. As with the bolt cutter, they return at double speed, threading 4 nuts at every operation. The mechanism is very accessible for inspection.

A very simple form of tap is used which can be made at a much lower cost than the ordinary nut tap. Provision is made for adjusting the distance the taps are driven in before reversing, to suit different thicknesses of nuts.

The nut blanks are placed in the hopper, which is divided into a series of cells by radiating webs. The nuts are discharged on a revolving plate which throws the nuts to outer edge by centrifugal force where they find their way into the four chutes leading to the taps. At the lower

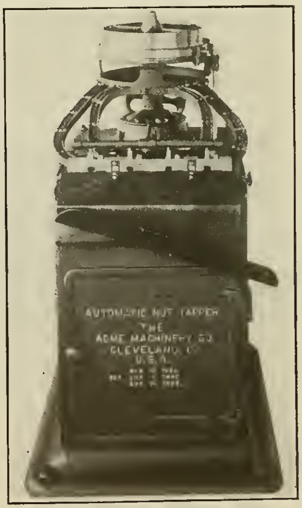


ACME BOLT THREADER.

end of the chutes they are pushed to the taps, held during the threading and are ejected after that operation.

Here, too, is the device for relieving the nut feed should a ragged nut or other obstacle find its way into the machine. The action of this is the same as in the other machine, and effects only the obstructed chute. There is also relief to prevent tap breakage. In fact the machines are all that one would expect to see from this firm, which has a reputation of high order for machinery of this kind.

The range of the nut machine is the same as the other, and the capacity, 16,000 $\frac{3}{8}$-nuts per day of 10 hours. One man can attend 10 machines, which makes an enormous output per man each day.



ACME NUT TAPPER.

Moguls for Japan.

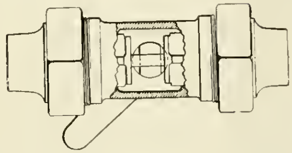
The mogul shown is one of twelve just shipped by the Schenectady works of the American Locomotive Co. to the Kuishiu Railway of Japan. They are rather heavy engines for 3 foot 6 inch gage and are the second shipment of a good sized order. They are in charge of Mr. George H. Jackson on board the steamship "Veronia," and make up part of her cargo of 12,000 tons.

The route is to Gibraltar, Suez Canal, Singapore and Yokahama, where they are to be delivered and erected. Erecting engines in a foreign land is decidedly different from the same operation on a "home" road, both on account of the native labor and the fact that locomotives are shipped boxed in pretty small pieces, and erecting means almost all that the name implies in the home works. The Japanese shops are, however, equipped with traveling cranes and other appliances, so that there is no trouble on that score. They will be run by native engineers. The leading dimensions follow:

Weight on drivers—78,000 pounds.
Weight on truck—13,500 pounds.
Weight total—91,500 pounds.
Wheel base, driving—11 feet 11 inches
Wheel base total, eng.—19 feet 5 inches.
Cylinders, dia. x stroke—17 inches x 24 inches.
Driving wheels—diameter, 54 inches.
Driving wheels centers mat'l—C. S.
Driving journals—7 inches x 8 inches.
Engine truck wheels—28 inches.
Engine truck journals—5 inches x 8 inches.
Boiler—Diameter, 58 inches.
Boiler pressure—180 pounds.
Firebox, length x width—82 inches x 29⅝ inches.
Tubes—Number of and diameter, 190—2-inch.
Tank, water capacity—2,500 Imperial gallons.
Tank, fuel capacity—2⅘ tons.

ONE OF TWELVE FOR JAPAN—SCHENECTADY WORKS OF AMERICAN LOCOMOTIVE CO.

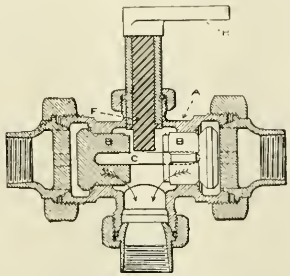
Tubes—Length, 11 feet 1 inch.
Heating surface, tubes—1091.22.
Heating surface, firebox—105.67.
Heating surface, total—1196.89.
Grate [illegible] 16.86.
Tractive power—196.50.
Factor of adhesion—3.97.



AUTOMATIC CYLINDER COCK

Lunkenheimer Locomotive Pattern Automatic Cylinder Cock.

We illustrate herewith a sectional view of the Lunkenheimer locomotive pattern Automatic Cylinder Cock, which is being



DETAILS OF CYLINDER COCK.

quite extensively used on some makes of compound locomotive engines. This cock is very simple in construction and has been giving excellent results.

The device consists of a valve casing *A* containing two wing valves *B B* connected together by a loose pin *C*. These valves *B B* open and close alternately as steam is admitted and exhausted through the opposite ends of the cylinders to which the inlets of the cock are connected. In this manner they are continually in operation and constantly relieving the cylinder of condensation.

The stem *F* is arranged to be operated by a lever from the cab, so that by turning it to central position both valves *B B* are held off their seats and the condensation will drain out of both ends of the cylinder to which the cock is connected.

This device is manufactured by The

Lunkenheimer Company, of Cincinnati, O., who will be pleased to give full details upon application.

Flather Frog and Switch Planer.

The planer illustrated herewith is a heavily built machine for steel forges and switches, and is made by the Mark Flather Planer Company, Nashua, N. H. It is equipped with two, three, or four heads on cross rail as desired, and has power elevation.

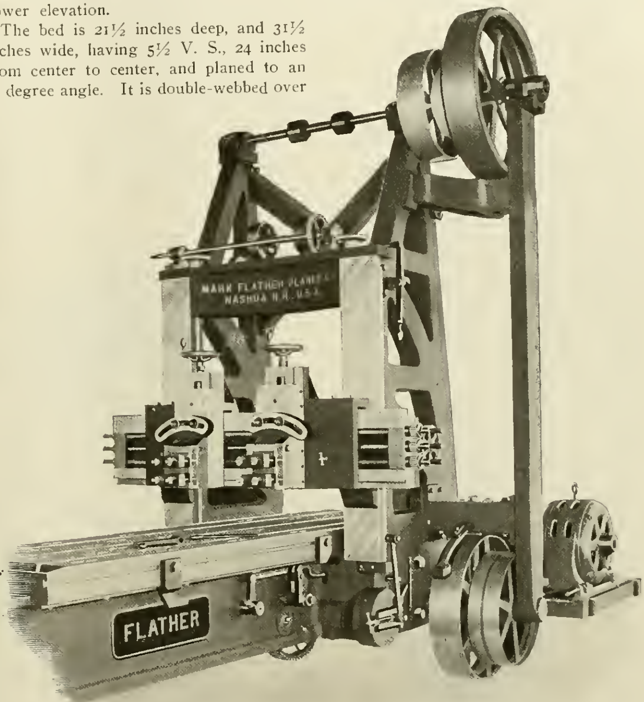
The bed is 21½ inches deep, and 31½ inches wide, having 5½ V. S., 24 inches from center to center, and planed to an 80 degree angle. It is double-webbed over two-thirds of its length, and given a length of 20 inches for every foot of table lengths.

The table is about 14 feet 8 inches over all, 42 inches wide, 7¾ inches deep and has four rows of cored holes, or any other arrangement of holes which may be desired. The return speed is about 3 to 1 and the cutting speed of from 14 to 16 feet per minute. Table rack is 8½ inches wide for the teeth, and 12 inches over all.

The housings are of the box body type and exceptionally heavy, 9½ inches face. The bearing of cheek is fastened to cheek by 7 bolts and is also fitted over cheek and keyed to it, giving unusual rigidity. Cross-rail raising screw $1\frac{9}{16}$ inches diameter, three threads to each.

Cross-rails are 16½ inches wide and long enough to permit of either head being run out of the way of other to the full capacity between housings. It is braced in box form, fastened to the housings by two heavy binder caps with three 1⅛ inch bolts holding each.

There is a vertical feed of 12 inches, 4 clamping bolts, 1⅛ inches diameter. Saddle bearing on cross-rail of 24¼ x 2¾ inches. Slide bearing 24 inches long and slide is 10½ inches wide.



FLATHER FROG AND SWITCH PLANER.

The planers are driven by cut cast steel gears and forged steel pinions, have four shafts, double train of gearing. All gears are contained inside of bed, avoiding the objection of gears outside where the operative can come in contact with them. Rack gear has 8½ inch face and two pitch teeth. Ratio of belt speed to table is about 104 to 1. This arrangement gives a most powerful drive and the gears are entirely covered with the shield to prevent chips from going through the table onto them. Racks are planed and cut from solid steel forgings.

Special shipper plates, moving but one belt at a time, preventing the annoying squealing of belts, all connection rods, etc., easy of access. Belts can be shifted from either side of the machine.

The power feed, longitudinally and vertically is operated by a patent relief friction which can be easily adjusted where the machine is running or at rest without danger to the operator. The planer is very heavy, weighing about 45,000 pounds.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters in the waste basket.

(120) J. R. P. asks:

What is the best composition for fusible plugs. A.—The leading locomotive builders use a mixture of tin and lead in the proportion of one part tin and three parts lead.

(121) C. B. Du B. asks:

Will you kindly give me a good method for determining the clearance volume of a piston valve engine? A.—The most correct way of finding cylinder clearance is to put the piston to the end of the stroke and fill up clearance spaces with water through the steam port. Then draw off the water and weight or volume will give cubical contents.

(122) G. H. G. asks:

What is the difference in amount of water that a high and low pressure injector will throw? A.—This depends on pressures. Kneass, the best authority on injectors gives a table which shows that with 40 pounds of steam pressure, 23 pounds of water should be delivered per pound of steam; with 100 pounds pressure, 15 pounds of water, and with 200 pounds pressure, 10.3 pounds of water per pound of steam.

(123) R. A. B. writes:

How can I find out the dimensions of a boiler that will be capable of supplying steam to an engine that is said to be capable of developing 30 horse power? A.—The horse power of a boiler is the capacity to evaporate 31 pounds of water per hour from a tank temperature of 100° F. and to a boiler pressure of 70 pounds per square inch. People wanting information of this character ought to consult *Kent's Mechanical Engineer's Pocket Book*.

(124) H. H. B. asks:

If an engine of any kind breaks a main pin or wheel so as to disable that side, is it necessary to take down side rods on the other side? A.—The rod question is a common one. Breaking a main pin necessitates taking down all the side rods on *both* sides which are in any way dependent on it. With a ten-wheel engine connected on center wheels as usual *all* the side rods must come down on both sides. The reason for this and other causes will be explained in an article in the body of this paper. This will also answer your question about the eccentrics not being on the main axle.

(125) J. C. C., Bowling Green, Ky. writes:

What size netting (that is, how many meshes to the inch and what size wire) is most generally used by the leading roads in this country in the front ends of their engines having extension front ends and a brick arch in firebox? And is there any material difference in the way the netting is put in the front ends by the different roads? A.—The netting pretty generally used is two and a half meshes per inch, and of number eleven wire. The horizontal portion of the netting when in place in the front end is about four inches below the top of the nozzle tips. The oblique portion runs off at an upward angle of about forty-five degrees.

(126) C. P. writes:

Please explain the principles on which a steam gage works. A.—Gages are made on two plans. The Bourdon spring and the diaphragm types. The former have a bent tube which the steam fills and tends to straighten. This is connected to pointer which it moves. In the other the steam acts against a flexible diaphragm, which moves pointer when it is forced out by the pressure. 2. What per cent. of oxygen is in the air? A.—Oxygen is 20.7 parts by volume and 23 parts by weight. Remainder is nitrogen. 3. What is the igniting temperature of carbon and oxygen? A.—Unfortunately there is very little actual information on this subject.

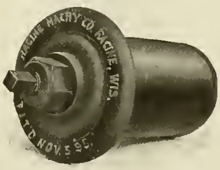
(127) B. M. O. asks:

What are the principal causes that make an engine ride roughly? A.—The principal cause is the running-gear not being properly adjusted so that the weight is transmitted evenly to the springs and from thence to the axle boxes. Springs too heavy for weight of engine will also cause rough riding. An engine that has the valves set so that there is too much compression in the cylinders will ride rough when working at short cut-offs. A very common cause for rough riding is dry or partly dry wedges. Graphite mixed with the oil when applied to wedges once in fifty miles will be found a royal remedy for rough riding. An engine run down so that the wheels are out of round and differing in size will ride roughly, and the only remedy is a visit to the back shop.

(128) A. A. P. asks:

What is the generally accepted water consumption per horse power hour? A.—This varies from about 11 pounds in the best large stationary engines to probably 100 pounds in very small poorly built engines. Locomotive practice also varies

widely, probably ranging from 25 to 50 pounds. 2. If your steam gage should be destroyed what should be done? A.—This is one of the cases where a man must use his best judgment and consider circumstances. If you knew your safety valves were all right, it would probably be best to keep on and take your train in. If you get too much steam your "pops" give warning, and if too little you fail to make time. 3. How many heat units in a pound of good anthracite coal? A.—Varies from 11,500 to 13,000, according to *Kent's Pocket Book.* 4. How does the temperature of steam vary with pressure? A.—It requires increase of heat to produce higher temperature, consequently high pressure steam is hotter than lower. 5. What is the maximum height of a double acting pump can lift from? A.—The theoretical limit is 34 feet, practically 26 or 28 is a high lift.



RACINE BOILER FLUE PLUG.

A New Boiler Flue Plug.

Plugging a flue isn't a pleasant job under any circumstances, but it is some satisfaction to have it stay plugged. Then, too, the usual iron plug has to be driven in as best you can, and doesn't help the flue or the sheet either.

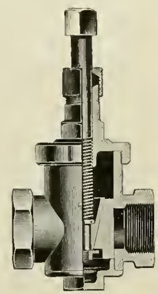
The flue shown, which is called the "Lightning" and is made by the Racine Machinery Company, Racine, Wis., is made up of two peculiar shaped flanges or washers on a heavy steel bolt and a pulp tube which can be expanded to fill the tube by screwing up the bolt. This pulp tube is a specially prepared composition which makes an absolutely tight joint and has such a grip that no steam pressure in use can blow it out. Another good feature is that the plug can be used over and over again by simply renewing the pulp tube, which can be done at a small cost.

Mr. H. J. Raps, general foreman of boilers of the Burlington, Cedar Rapids & Northern Railroad, who is well known to our readers, inserted some of these plugs at the request of Mr. Bushnell, the master mechanic, and gives a good report of them. The locomotive, carrying 160 pounds of steam, made 32,000 miles (in ten months) after plugs were inserted, and gave no trouble whatever, being in good condition when removed. The composition became as hard as iron and adhered to flue so closely that it was removed with it.

This appears to be a big improvement over anything else in this line, and should prove popular with railway men generally.

The Ashton patented blow-off valve as shown in the cut is a new device of considerable merit, which is being rapidly introduced among the railroads by The Ashton Valve Co. of Boston, Mass. The features of construction which specially recommend themselves, are the ease with which it can be opened and closed, giving a full area of straight opening when valve is open, and a perfectly tight seating when closed, combined with great durability. It does not depend on the pressure in the boiler to make it tight, as in some blow-off valves, on account of the split piston or plug being expanded by the wedge in the final movement of closing.

The ease with which it can be opened is due to the first movement, which releases the wedge and removes the expansion of the piston, and allows it to move up freely into the top of the casing, there being no drag on the face of the piston to cut it, for whatever pressure there is in the boiler carries it back from the face. The tightness of the valve is not effected by scale, and whatever accumulates at the bottom can easily be removed by taking off the lower cap Railroads which have had this valve on trial for the past two years state that it is the most durable valve they have used. The manufacturers solicit trial orders

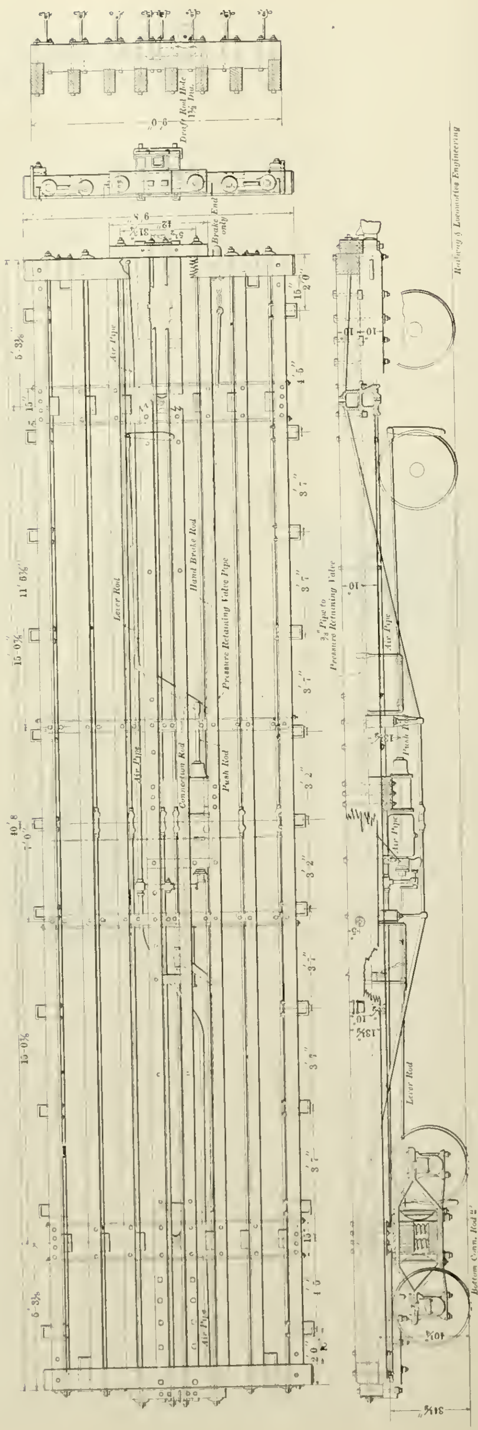


ASHTON BLOW-OFF VALVE.

from any roads which have not yet had an opportunity to demonstrate its merits.

Some steam railway companies that are losing their suburban business by parallel trolley lines are inclined to adopt the tactics which have been used successfully by their electrical rivals. But most of the desire to gain back lost business will end in empty talk.

A curious apparatus for oiling piston rods, cylinders and guides of locomotives has been introduced into Sweden. The principal part of the invention is a vessel where oil and steam are intermixed and then the mixture is ejected to the part to be lubricated. It has worked so well that orders have been given to apply it to all locomotives belonging to the state railways.



80,000 POUND FLAT CAR FOR PLANT SYSTEM.—SEE PAGE 193.

A Heavy Flat Car for Plant System.

The shipment of extra lengths of timber used in car, ship and bridge building, from points in the lumber districts along the lines of the Plant System, made it necessary to build cars that would stand extraordinarily heavy loadings. The 34 and 36-foot cars proved entirely inadequate in both length and capacity.

Continued service has proved the wisdom of the designs as they have been used for all sorts of loads and have neither run hot or settled down on side bearing.

They have 8 sills and 8 1⅛-inch truss rods having ends enlarged to 1⅜ inches. The side sills are of long leaf yellow pine 5½ inches wide by 13½ inches deep, screwed to end sills by ⅞-inch through bolt with large washers. The four intermediate sills are of the same material and are 5 x 10 inches, while the two center sills are 5½ x 10 inches. End sills are 9 inches wide by 10 deep.

Drawbars are of M. C. B. standard, and the American Continuous Drawbar Attachment is used. Body bolsters are cast steel with centers conforming to Plant System Standard.

Westinghouse brakes, McKee slack adjusters and retainer valves are used while the hand brakes are located as shown on plan of car.

Trucks were built to meet the M. C. B. tests, and standards for 80,000 pound trucks, the arch bars being as follows:

Top bars 1½ x 4½ inches.
Bottom bars 1⅜ x 4½ inches.
Tie bars ⅝ x 4½ inches.

Boxes are cast iron, M. C. B. standard and have spring covers. Wheels are 33 inches in diameter.

The main dimensions follow:

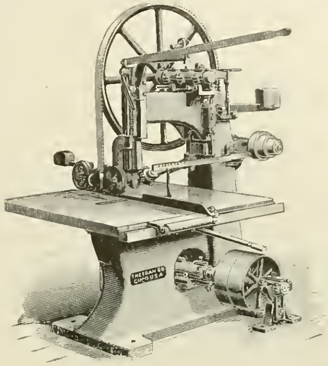
Capacity ....80,000 pounds
Length over end sills ....40' 8"
" " " blocks ....41' 6"
Width over end sills......9 feet 8 inches
" " side sills ....9 feet
" " stake pockets, 9 feet 8 inches
Height of rail to center of drawbar 34½ inches.
From center to center of body bolsters 30 feet 1¾ inches.

The cars were made by the Georgia Car and Manufacturing Co., Brunswick, Ga.

Improved Band Rip Saw.

If any of our readers have much ripping to do, the machine shown herewith is bound to prove interesting, as its makers claim it will surpass in quality and quantity anything in this line they are now using. It is made by the J. A. Fay & Egan Co., of No. 445 West Front street, Cincinnati, O., is called their new No. 1 Self Feed Band Rip Saw.

Special attention is invited to the fact that it will rip either hard or soft wood 1 to 10 inches thick without changing blades, and all the different adjustments are made easily, quickly and accurately. It will rip 24 inches wide. It will accomplish the work of several circular rip saws, and is besides much safer to operate, as there is no danger of the stock striking the operator. Owing to



IMPROVED BAND RIP SAW.

the thinness of the saw blade the slight saw-kerf removed is a point in saving which will be readily appreciated by all users of fine lumber.

The straining device, used in connection with the top wheel hanging on a knife-edge balance, insures at all times under all ordinary conditions a perfect tension on the saw blade—one of the most important points on a band saw to prolong its life.

The feed is very powerful and steady, and the feeding-in and feeding-out rolls being close together short stock can be worked to advantage. By a single movement of a lever the machine can be used as a hand-feed rip saw. For establishments where flooring is made in large quantities, the machine can be fitted with a long table, on which are rolls for returning the material for the next cut, thus saving much valuable time and attention.

The Westinghouse Machine Co., Pittsburg, are now proprietors of the Parsons Marine Steam Turbine patents, and they have effected some improvements upon the engine and now call it the Westinghouse-Parsons Steam Turbine. They have recently built a number of engines for electric light and electric power stations which are giving entire satisfaction and indicates that the reciprocating engine will have some difficulty in holding its own against the new rival. One steam-turbine of 600 horse power recently tested does the work with about 15 pounds of water per horse power per hour. We understand that a British ship builder has received from Mr. A. L. Barbour, New York, an order for a steam-turbine of 2,500 horse power, to be used in a pleasure yacht.

The Central Railroad of New Jersey people are feeling proud over the fast run they made with J. Pierpont Morgan from Philadelphia to Jersey City. The distance is 90.2 miles and it was covered in 84.5 minutes.

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XV. 174 Broadway, New York, May, 1902 No. 5

Wide Firebox Consolidation Freight Engine for Norfolk & Western.

The Norfolk & Western Railway has of late years attracted much attention in regard to their heavy equipment. Operating in a territory and with a class of traffic requiring the hauling of heavy tonnage, they have naturally adopted large capacity cars and engines. Their standard freight engine is now class "W," a consolidation type engine, with 21 x 30-inch cylinders, 56-inch drivers, having about 150,00 pounds adhesive weight. The first lot of these engines, thirty in number, were made by the Baldwin Locomotive Works. They had slide valves, and were delivered in 1898-9. In 1900 the railroad started to build engines of this class in Roanoke shops, changing the design in several ways, providing 5,000-gallon tenders and piston valves instead of slide valves. They now have 75 of this class in operation, and 48 more are being built by Baldwin & Richmond. The Roanoke shops will probably add several more during 1902, an order for 5 now being on the books.

Of the 75 engines now in service, 74 have the ordinary firebox, 41¾ inches wide, resting on the frames. Engine 843 was built with a view to experimenting with a wide firebox, and the performance has been such as to decide the management to adopt the design as standard, and the above orders are for engines with wide fireboxes, and in accordance with the drawings herewith.

The modifications of the original design of these engines were made in the office of Mr. C. A. Seley, mechanical engineer, under the supervision of the superintendent of motive power, Mr. W. H. Lewis, to whose courtesy we are indebted for the description and drawings.

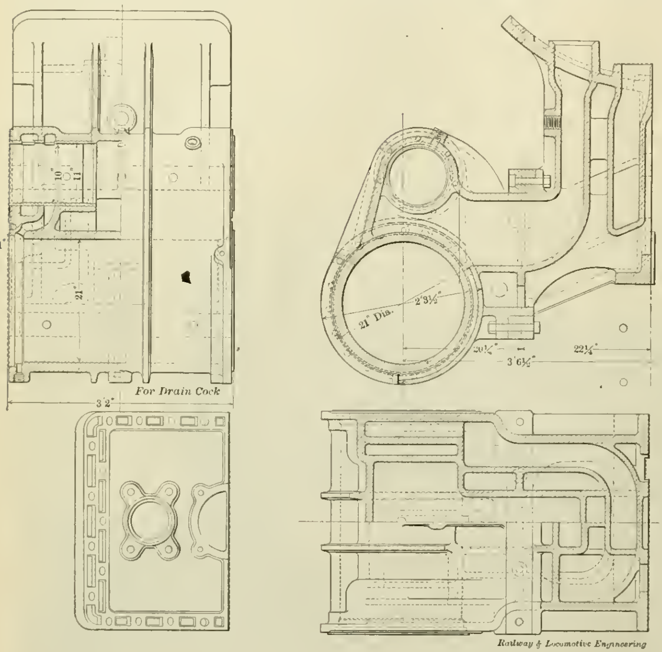
The principal dimensions follow:

Weight on drivers, lbs	150,000
Weight on truck wheels, lbs	18,000
Weight total	168,000
Wheel base, total, of engine	23′ 11″
Wheel base, driving	15′ 6″
Wheel base, total engine and tender	50′ 4″
Length over all, engine and tender	59′ 0″
Height, center of boiler above rail	8′ 6″
Height of stack above rail	15′ 1″
Heating surface, firebox	156 sq. ft.
Heating surface, tubes	2,318 sq. ft.
Heating surface, total	2,474 sq. ft.
Grate area	47.3 sq. ft.
Drivers, diameter	56″
Truck wheels, diameter	30″
Journals, driving axles	8½″ x 10½″
Journals, truck axle	6″ x 10″
Main rod length center to center	10′ 4″
Valve, travel	6¼″
Boiler, working pressure	200 lbs.
Boiler, diameter at front sheet	64″
Tubes, number	273
Tubes, material	Charcoal iron
Tubes, outside diameter	2¼″
Tubes, length, over sheets	14¼′ 6″
Firebox, length	112½″
Firebox, width	64¼″
Tank capacity, water	5,000 gallons
Tank capacity, coal	10 tons
Tender truck wheels, diameter	33″
Tender truck axle, journals	5¼″ x 9″
Tender truck axle, diameter of wheel fit	6⅜″
Tender truck axle, diameter of center of axle	5⅜″
Length of tender frame over buffers	22′ 3¾″
Length of tank	19′ 0″
Width of tank	9′ 0″

NORFOLK & WESTERN CONSOLIDATION.—CLASS W.

Equipment.
Latrobe Steel Co. tires.
Nathan sight feed lubricator.
Ashton safety valves.
Leach sander.
Monitor injectors.
American driver brake equipment.
Westinghouse tender brake equipment.
Ashton steam gages.
A. French Spring Co. engine driving and tender springs.
United States piston and valve rod packing.
Keasby & Mattison boiler lagging.

These engines have given excellent service, and are good steamers; their rated tractive power is 40,160 pounds, and they have exceeded this in indicator tests. They will pull 1,100 tons up a 61-foot grade with moderate curvature.



CYLINDER OF NORFOLK & WESTERN CONSOLIDATION.

The American consul stationed at Edinburgh, Scotland, reports that vessels belonging to Scotch ports have been carrying wheat from America for two cents a bushel. As might be expected, the consul reports that steamship owners are losing money and that their vessels do not come near paying expenses. The condition of affairs described is the result of unrestricted competition. This is the business that many politicians in the United States are scheming to share. They want the people to tax themselves to pay gratuities that may induce capitalists to enter the ship-owning business. When owners of foreign ships have to encounter starvation conditions while paying sailors less than half the wages that American sailors must receive, it takes magic arithmetic to figure out how American shipowners could compete with foreigners and pay their help.

The Expense of Mistakes.

THE ROUND-HOUSE END OF IT.

(Fifth Paper.)

BY F. P. ROESCH.

In considering the expense of mistakes, it would hardly be fair to the engineer to cease the subject without a word in regard to the one man who is almost equally as responsible for the condition and maintenance of the engine as the engineer himself. I refer to the round-house foreman. I hold him equally responsible, because, though the engineer be ever so careful and painstaking in locating and reporting the defects on his engine, if the round-house force, either through indifference, lack of time, or neglect, does not see fit to make the repairs reported, we should not in justice hold the engineer responsible for any future damage that may ensue, through failure on the part of the foreman to do his duty as thoroughly as we expect it from the engineer.

There are not many men in the lower ranks of railway officials, who can singly, so increase or decrease, the maintenance and opperating cost as the round-house foreman, especially where business is rushing and power is scarce. Much, very much indeed, depends on his judgment. He makes frequent mistakes, but they are not always brought home to him. Frequently the engineer must shoulder the onus resulting from the foreman's mistakes. I recall a case where the whole side was stripped off an engine, through failure to take up the end motion in a cross-head gib. The foreman who considered this work—reported—unnecessary, escaped scot free, the engineer got 30 days, because the gib broke.

All round-house men do not realize what road conditions are. They fail to see, that, what they consider a mere trifle, may be the cause of no little worry to the engineer, often resulting in quite a loss of time, and sometimes in a complete engine failure. For this reason where round-house foremen have had no road experience, they should post themselves as thoroughly on road conditions as possible, either by taking an occasional trip over the road—but on an old freight engine always — or by frequent talks with engineers, gather all the information possible, in regard to their troubles, trials, etc. It is simply to try to make those who have never given the subject a thought, realize what it costs to neglect certain jobs or defects, that I call attention to the following, and most frequent mistakes.

A frequent and very expensive mistake made in the round-house is, permitting an engine to go out, knowing that she is not exactly in condition to handle her full rating, or make a successful run. Yet how often do we see and hear lame, wheezy engines tugging out a string of cars, trying to get them out of the yard, where as if the engine were in the condition she should be, she would take the train without any trouble whatever.

The round-house foreman will tell you, it is the pressure brought to bear on him by the train masters, that forces him to run the engine out in this condition. This may be true to a certain extent. We must admit, that it is the transportation department that keeps the mechanical department hustling; but the train master, unless he is a fool, realizes that we are all working for the common good; that we must work together, to make our road a dividend payer, and if the round-house foreman will take the trouble to explain to him, that the engine is hardly fit to make a successful trip until he has completed some necessary repairs, I believe the train master would willingly "set the train back" two or three hours in order to give the round-house force time to do so.

Of course this does not apply to passenger, fast freight or stock trains. These trains should be properly provided for in advance; ordinary freights are not so pressing however. There is no economy in sending out an engine that "can't do business."

The dispatcher may claim that not being able to get an engine when ordered, disarranges his schedule or program as laid out. Is not his schedule just as liable to derangement, by the incompetent engine after he does get her? Is not this engine liable to "fall down" on

the road, and so disarrange all his calculated meeting points, etc., and in so doing will it not cost the company more money in overtime and delays to other trains, than if the engine had been held two or three hours until proper repairs were made? The money all comes out of a common treasury. The round-house, the dispatchers and the train masters' offices should come closer together. I believe that if all three were located under one roof, each department could learn considerable from the other. From the way that engines are often ordered out by dispatchers or train masters, it seems as though many of these officials labor under the delusion that the only difference between the engine and caboose is, that one is attached to the head end of the train and the other to the rear. That the former can be turned and sent back as easily as the latter. A few weeks in the round-house would soon undeceive them.

But as it is, the round-house man under pressure, will continue to make the mistake of sending out engines that should be held in, and the expenses keep on increasing.

Under this head, of engines that can be sent out and may worry a train over the road are: First,

THE LEAKING ENGINE.

An engine with "weak" flues or "tender" fire-box, should never be sent out until a competent boilermaker has thoroughly worked over all leaking parts, and pronounces it, in his opinion, in condition to make a successful trip. A boilermaker caulking a leaky fire-box should not be hurried. Let him take time enough to do a good job. Give him to understand that it is quality not quantity of work that is required.

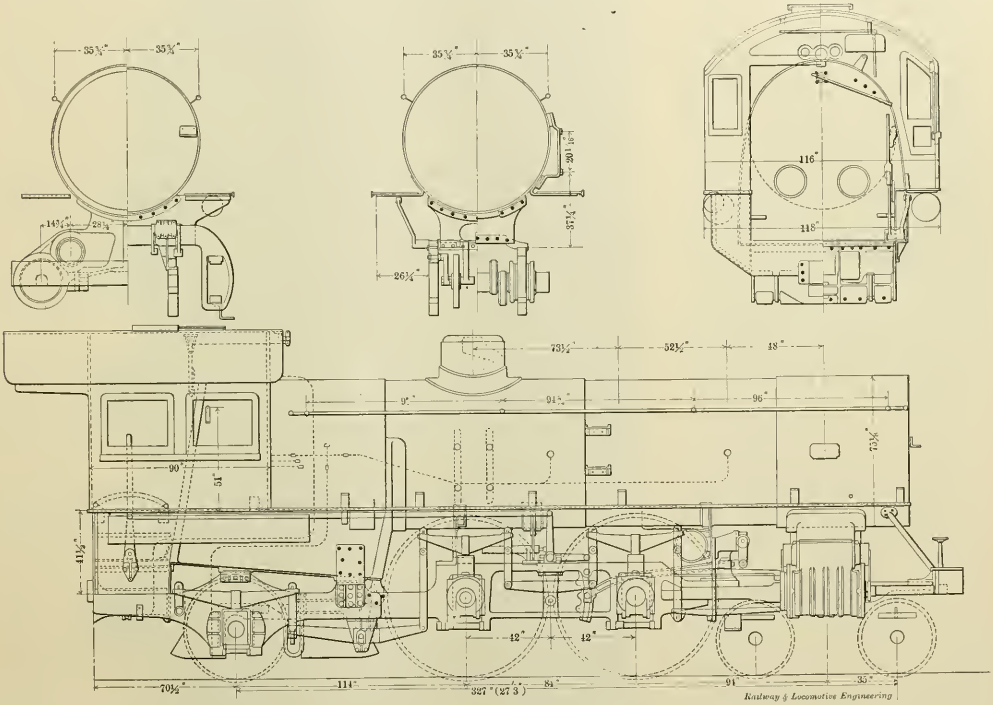
This "hurry up" business, in bad water districts, don't pay. Suppose you dry up the leaks by caulking the flues slightly, when they need rolling, what is the result? Simply this. The first few hard exhausts start flues leaking again. If the train is not too heavy, or the division too long, the engine may take her train through, by hard work on the part of engine crew, but more frequently the train must be reduced, or entire train set out, in order to keep steam enough to bring the light engine in.

Have you ever figured out the cost of having an engine give up her train half way over the road, and come in light? Or as often happens, be towed in? $50.00 won't cover it!

It is a costly mistake in other ways to send an engine out in this condition. You may say, "this engine was properly caulked before leaving." Begging your pardon, I must differ from you. We will follow this engine to the other end of the road. The fact that the engine gave up her train is a strong hint to the foreman that the fire-box needs serious attention. Consequently the engine is held and caulked right. She goes out and makes return trip O.K.; not only the return trip, but several trips before she again gives any trouble. Now is not the very fact, that engine after giving up train once, is able to make not only one but many successful trips afterward, conclusive evidence that the work was not done properly on the first trip. Many of our engine failures, due to leakage, can be avoided with a little more care and properly directed attention. Give the boilermaker plenty of time. Then hold him responsible.

THE "LAME" ENGINE.

A "lame" engine is one of the most expensive pieces of machinery that can be operated. Nothing will rack an engine more than to have her cutting off at three feet at one end of the cylinder and nine feet at the other —and a blade need not be slipped much either to produce this—not only will such an engine soon pound her-



ERECTING CARD AND DETAILS OF NORFOLK & WESTERN CONSOLIDATION.

self to pieces, but she will take more time, consume more coal in one trip than it would cost to square her twice over. Eccentrics are usually keyed on now-a-days and do not slip. So the lameness is usually due to badly worn parts or slipped blades, but whatever the cause the engine can be equalized in the running cut-off in very little time. A wooden V block clamped over valve stem to take up lost motion, same as it is taken up by pressure on the valve when engine is working; lever hooked up in running notch, and engine pinched one revolution to catch the travel, is all that is necessary. An hour or two at the most should be ample time to make all necessary alterations, when eccentrics are not moved.

THE FOAMING ENGINE.

When an engine requires washing she should be held and washed. The extra cost of running a foaming engine over a division, if figured in dollars and cents, would be surprising to many. The loss of time, extra fuel, oil, and wear and tear on valves and cylinders, would bring it up to quite a respectable figure. I believe more valves are cut on account of foaming than through any other one cause. Not only this but when an engine is foaming it is evident that considerable of the foreign matter in the water is still held in solution, it can therefore be readily washed out. If allowed to remain, it will settle or bake on the iron, and soon affect the steaming of the engine as well as the life of flues and fire box.

SMALLER COMMON MISTAKES.

A common mistake in the round-house is that a little slack between engine and tank don't amount to much. It amounts to from $2.00 to $5.00 every round trip, according to the price of coal, to say nothing of the damage to sills and draft rigging of tank. Draw bar slack, especially on a fast run, will waste more coal in one trip, than the fireman will waste in ten by injudicious firing. Keep up the slack and see how your coal record will come up.

Engines frequently come in with driving boxes reported in need of packing. The foreman will feel of the wheel hub, perhaps an hour or so after the engine gets into the round-house. He finds it comparatively cool, so makes the mistake, especially if a trifle rushed, of thinking it don't need packing, and lets it go. It is not very safe to take chances on a report of this nature, especially as the cost of packing is so small, and the damage through neglect can be so great. Don't take any chances with hot driving journals. You are as liable to be mistaken as to the requirements of the driving box, as the engineer, and a mistake of this nature is liable to prove very expensive indeed. Engineers are not always furnished oil enough under present allowances to have any left over to use in packing cellars. The result is that engineer will either cut the journal, loose time, or both; either is expensive.

It is on just such things as this that the round-house foreman's judgement is liable to be at fault. He will often fix up side rods, because he can see the brasses loose or gaping open, while the coal is blowing through the valves or cylinder packing by the carload. What harm if an engine does pound a little so long as she gets the full benefit of her steam? The side rods don't pull the cars. It is the valves and packing. It is in knowing what can safely make another trip and what needs immediate attention, that the strictly machinist foreman is apt to make mistakes, and for this reason, I believe that the successful round-house foreman of the future will be an up-to-date mechanic, who has had some road experience, either as a fireman or an engineer.

Let us hope also that he will be paid according to his responsibilities and deserts. A first-class man in this position deserves first-class pay. A poor man is not worth keeping at any price.

Railroad Companies Not Responsible for Death of Deadheads.

A curious law suit was decided last month by the Circuit Court of St. Louis. The suit was brought to recover damages for the death of Harry G. Purple, who was killed in a rear end collision between Laramie and Cheyenne, Wyo., on October 15, 1899. The train upon which Purple was riding was a freight train and was not permitted to carry passengers. Purple, however, was a former conductor of the railroad company and was riding upon the train with the consent of the trainmen in charge of it. The railroad company claimed that under the circumstances it was not liable for Purple's death even though guilty of negligence.

Under the decision of the Court of Appeals a railroad company is not liable for the death of a person riding upon a freight train which is not permitted to carry passengers, even though the person was upon the train with the knowledge and consent of the men in charge of it.

Some time ago Senator Depew told a delegation of visiting English railway officials that the reason their roads were so far behind American roads in earning power was because the English managers lacked the courage to start a scrap heap for antedated locomotives. Doubtless there is considerable truth in this assertion, and we can take much of it to ourselves; for to an observing person it will be quite apparent that while our own scrap heap is started, it is not kept as busy as it should be, judging from the still large number of antedated and shrivelled locomotives with which some of our large roads are double-heading.

Establishing Railroad Etiquette.

The Erie, which was our pioneer long line, established various practices of railroad etiquette, among them being the use of the train signal rope. The relative standing of conductor and engineer was also first established by train men belonging to the Erie.

Sometimes the conductor wished to stop a train between stations, but as there was no means of letting the engineer know his wishes, except by sending word by a brakeman, who had to climb and scramble over a dozen freight-cars before he could attract the engineer's attention, there was often a vexatious delay.

"Pappy" Ayres, the pioneer Erie conductor, hit upon an expedient for signaling to the engineer. He tied a stick of wood to a long rope, hung the stick in the engine cab, and carried the rope over the car tops to the rear of the train. His plan was to pull the rope and rattle the stick when he wished the train stopped.

The engineer of Conductor Ayres' train was conservative—"sulky," the conductor called him—and did not see fit to recognize such an innovation.

"Why didn't you stop the train when I pulled that rope?" thundered the conductor, after a flagrant refusal to notice the stick of wood signal.

"Cause no one told me to stop it," was the engineer's surly answer.

"Well, I tell you to stop it hereafter when I pull on that stick of wood," said the conductor. "If you don't—" he turned away muttering some sort of threat.

The very next run the conductor's vigorous pull on the rope was unheeded by the engineer. At the close of the day Conductor Ayres met the engineer with the words:

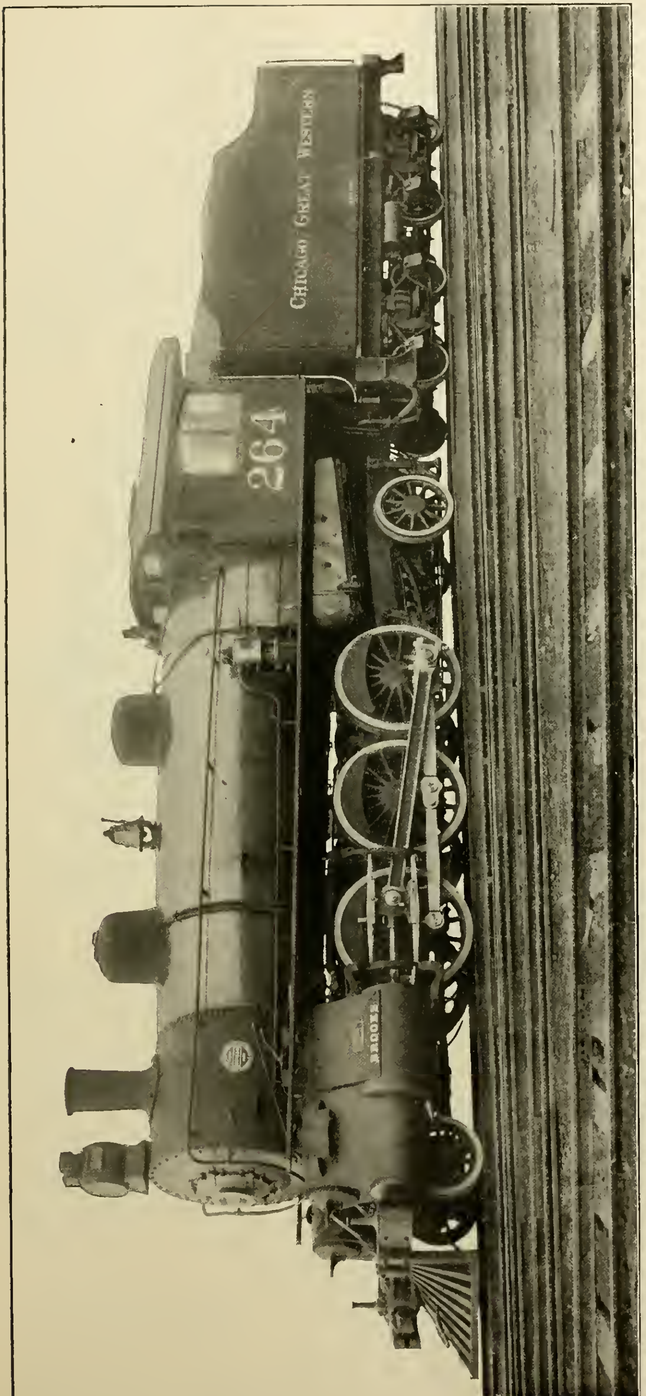
"See here, I've stood all the nonsense I'm going to. Just come out here, and I'll give you a good licking."

There was fire in his eye, and the engineer, noting it, turned mild at once.

"All right," he answered, amiably. "I'm willing to wrastle with ye, an' if ye can throw me I'll notice any signal, if 'taint more'n a bumblebee's buzzin', pervided ye can harness him so's to buzz when ye want the train stopped."

A wrestling match followed, in which "Pappy" laid the engineer low. The rope and stick worked to a charm after that, and soon led to the introduction of the now universal bell-and-cord system of signaling.

The apprentices and members of the Engineering Departments of the Westinghouse Electric and Manufacturing Company have formed the Electric Club, with rooms in the Hamnett Building, Wilkinsburg, Pa. They start with about 125 members, and every evidence of success.



BROOKS TANDEM COMPOUND FREIGHT LOCOMOTIVE FOR CHICAGO GREAT WESTERN.

New Freight Engine for the Chicago Great Western.

The Brooks Works of the American Locomotive Company have recently turned out the first of the twenty of what they call the "Lake Shore" type, but which bears such a close relation to the "Prairie" type of the Burlington as to make a new title seem almost unnecessary. The better way would probably be to designate by the Whyte system as a 2-6-2, meaning 2 truck wheels, 6 drivers and 2 trailers.

They are very heavy engines of the tandem compound type, being built on the same plan as those turned out by the Schenectady works for the Santa Fé, and which seems to be tandem compound adopted by the American Locomotive Company. They burn Illinois and Iowa bituminous coal and have a grate area of 48.5 square feet.

The leading dimensions follow:

Type:

Weight on leading wheels.............28,400 lbs.
" " driving " ....133,200 "
" " trailing " .... 30,100 "

" " total " .... 191,700 "
" " tender, loaded.............120,000 "

General Dimensions:

Wheel base, total of engine......29 feet 2 inches
" " driving ....11 " 4 "
" " total engine and tender.................54 " 2½ "
Length over all engine............40 " 11 "
" " " " and tender.64 " 9 "
Height center of boiler above rail. 8 " 8 "
" of stack above rail.........14 " 11 "
Heating surface, firebox........... 179 sq. feet
" " tubes..............3,071 "

" " total ....3,250 "

Wheels and Journals:

Wheels, leading, diameter............33 inches
" driving, " ....63 "
" trailing, " ....42 "
Journal, leading axles ....6x12 "
" driving...................9½x12 "
" trailing.....................7x12 "

Cylinders:

Cylinder, diameter, high pressure......16 inches
" " low " ......28 "
" stroke ....28 "
Piston rod, diameter.............. .... 4 "
Main rod length, center to center.........11 feet

Valves:

Valves, greatest travel..... ....5¼ inches

Boilers:

Boiler, working pressure.................200 lbs.
" diameter of barrel front......70⅛ inches
" " " " at throat...79⅝ "
Dome, " " inside..........30 "

Firebox:

Firebox, length.........................96 inches
" width ....74 "
" depth, front ....74 "
" " back..................63 "
Tubes, number of............................352
" material...................Charcoal iron
" outside.......................... 2 inches
" length over tube sheets..16 feet 8⅞ "

Tender:

Tank capacity for water............6,000 gallons
" " " coal.......................12 tons
Diameter of wheels.....................33 inches
" and length of journals......5x9 "
Width of tank inside.............9 feet 10 "
Height " " not including collar.5 " ½ "

Special Equipment.

Brakes, American for drivers.
" Westinghouse, for tender and train service.
Pump, 9½ inches Westinghouse Automatic.
Sight feed lubricator, Michigan.

Safety valves, Ashton.
Injectors, Hancock & Ohio.
Springs, French.
Metallic packing piston rods, Jerome.
" " valve stem, "

How the Pennsylvania Special Train Was Run.

BY THOMAS ALLEN.

President's Office, Sunday, March 23, 12.57 P. M.:

Get an engine and special train ready at once to take Mr. Cassatt to Jersey City, and at same time orders were given to restaurant for dinner for five in five minutes for president's car. "Be lively."

Engine 804, Engineer Martin H. Lee and Fireman Harry L. Pickel, were selected and at once got ready at 1.13 P. M., engine 804 having one 12-wheel combined car and president's private car (12 wheels), left Broad street station for Jersey City. As the notice was so short of time the road was not cleared for special until after passing Holmesburg Junction, 12 miles from Philadelphia, which took 17 minutes to run there on account of stopping twice on elevated road for red signals and at Zoological Garden for freight train to cross from one track to the other and nearly stopped at Frankford Junction for red signal, after which the road was cleared, making the distance from Holmesburg Junction to Jersey City, 78 miles, in 62½ minutes, including a slow down at Bristol, Trenton, New Brunswick, consuming 4 minutes through city of Newark on account of elevating the tracks and at Monmouth Junction taking water, arriving at Jersey City at 2.32½ P. M., or total of 79½ minutes for 90⅕ miles, or 72 minutes running time, taking out 7½ minutes detention. You can see this train speeded over the rails as no train ever did before.

One mile near Rahway was made in 30½ seconds, or nearly 120 miles an hour, on 25-foot down grade to mile. This, I believe, is the fastest mile ever recorded by a locomotive. This train ran from Rahway to Waverly, near city of Newark, 7⅕ miles, in 4¼ minutes, which I also think is the record.

SECOND DAY'S RUN.

President's Office, Monday, March 24, 11.27 A. M.:

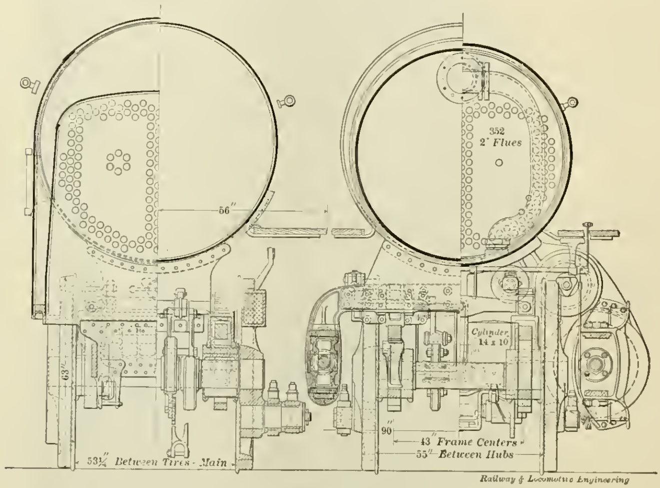
Have an engine and special train ready to leave Broad street station not later than 12.15 P. M. for Mr. Cassatt for Jersey City.

Engine 850, Engineer Jos. Rood and Fireman Jos. Killey, were selected at once and got ready; 850 left Broad street station at 12.19½ P. M., having same train engine 804 had the day previous.

The road was cleared for this special at 12 o'clock noon, nothing being allowed on its tracks until after it passed. They had no detention except slowing down for water at Monmouth Junction and through the city of Newark and it arrived in Jersey City at 1.38 P. M., covering 90½ miles in 78½ minutes, beating day previous by one minute actual time.

You can see the first day's run was far faster than the second, also on the first day they only had 16 minutes to get the engine ready, while on the second day they had 52 minutes and in this it shows the good qualities of both engines, men and roadbed.

Both engineers say that regular trains can be run at such speeds, but not at the present time, owing to so many freight and other trains being on the road, as the road would have to be cleared for them, which would be very expensive, causing many delays to trains and also would be very hard on machinery, rolling stock and roadbed.



CROSS SECTIONS OF BROOKS TANDEM.

How He Got His Promotion.

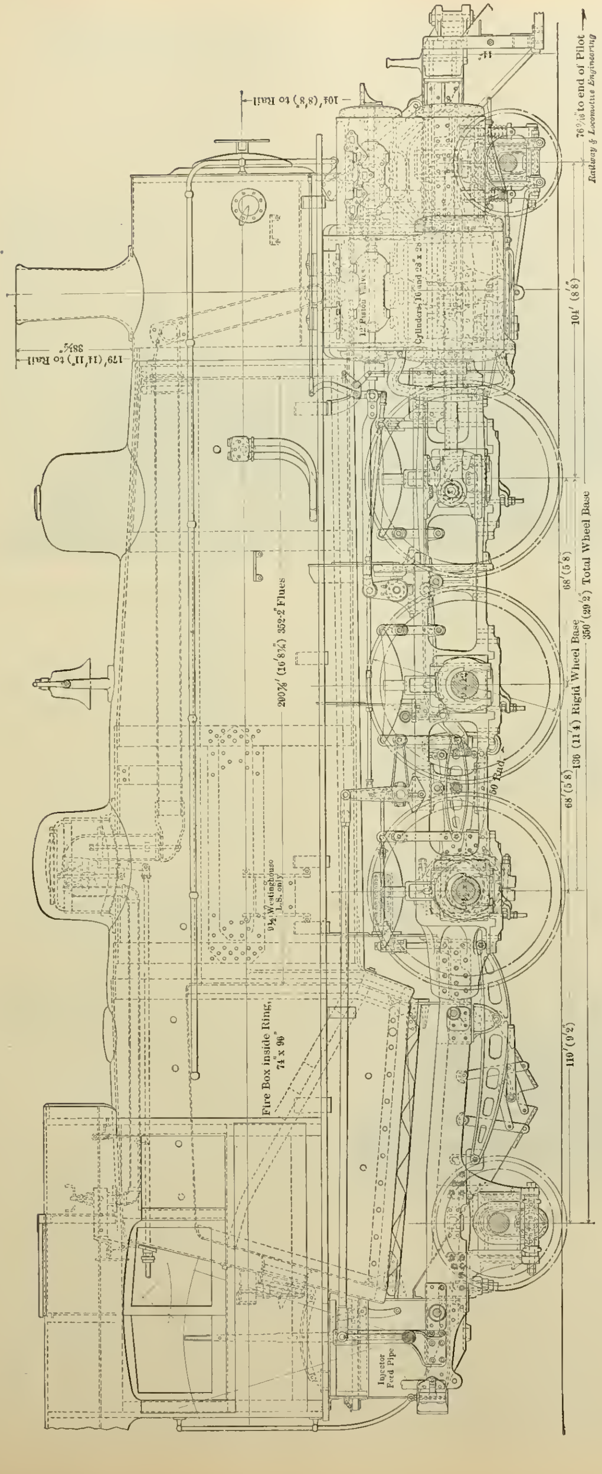
"Yes," said the fireman, "they gave me a big lift rather suddenly. I was promoted to the right hand side of the cab for bravery, and yet I was the fortunate victim of circumstances absolutely beyond my control. You see it was this way. I was firing for Old Pete on No. —, and we were climbing the grade with two baggage cars, three coaches and two Pullmans, and had the superintendent riding with us on the engine. A long freight train was dropping down on the westbound track, and about 600 yards ahead we saw a big 42-inch cast iron pipe 30 feet long swing from its moorings on a gondola and point right at our engine. The superintendent and Old Pete jumped, and I made a grand rush to get back over the tank into the baggage car, but the coal caved down with me and I slipped back faster than I could crawl up. The last time I rolled down I came near going into the open furnace door, and then scrambled to my feet again to find that the freight train had passed us and no damage was done. Then I jumped up to the engineer's seat and put on the air. After a while the 'super' and Old Pete came up, followed by the 'con' and half a dozen frightened passengers.

"The 'super' saw me at my post and complimented me, and I told him that rather than forsake the train I would have sacrificed my life. I was telling a big fib, and yet felt that no one saw me breaking my neck to get back over the tank, and that I ought to accept the glory that was thrust upon me. Well, they advanced me for bravery, but I'll bet $50 no one ever tried harder to get away from that pipe than I did.

"The big pipe had rolled back in its place just as it cleared us, and did no further damage until the next sharp curve was reached, when it swung around again, dropped down and derailed five cars."—*Pittsburg Post.*

In an address delivered at a banquet in Philadelphia celebrating the 70th anniversary of the Baldwin Locomotive Works, Mr. Stuyvesant Fish, president of the Illinois Central, made the statement that the West Feliciana Railroad, now a part of the Illinois Central Railroad, was the first interstate railway ever chartered or built. It was called the Feliciana and Bayou Sara Railroad, and extended from Mississippi into Louisiana, a distance of 27 miles. There must have been some enterprising citizens in that part of Mississippi in those days when they engaged in such an expensive enterprise to improve their methods of transportation.

"Life on the Smooth Line" is the name of a pamphlet published by the Joseph Dixon Crucible Co., Jersey City, N. J. It is a very amusing little story and will be sent free to any person interested in keeping bearings running cool.



BROOKS TANDEM COMPOUND FOR THE CHICAGO GREAT WESTERN RAILROAD.

The 144's Opinion of Pooling.

BY J. M'CURDY.

Sid McClure was not only the fireman on engine 144, but was also in love with that engine, and they understood each other well enough to carry on a conversation when they had nothing better to do. One day, while Sid was curled up on the seat box, waiting for No. 12 to come in from the West, he asked the 144 what she thought about pooling, and also ventured the assertion, "Don't you find it a greater drawback than anything the company has ever done?" Engine 144, having been in the service for some time, and had gone through about all of the trials and tribulations that falls to the lot of an engine, replied as follows:

"No, we don't look at it from the same standpoint that the enginemen do. Engines are more afraid of the abuse of the engine crews than they are of the neglect caused by the pool system. A poor fireman shortens our lives as often as does the inattention on the part of the shop force to needed repairs. Do you know that a large per cent. of the railroad men do not understand what pooling is? I can explain it, so you will probably understand it better by repeating an interesting conversation I overheard one day while waiting at Dunbar. You remember the day that the 'pusher' got into No. 31 at Heinig's bluff and delayed No. 12 at Dunbar about two hours and forty minutes?

While we were on the siding waiting for the track to be cleared a gentleman by the name of Lemar Bailey began talking about tramps. He said, 'There are different castes in the tramp species, and in order to define the caste in which the different crowds belong, one must have a general knowledge of all, with their different characteristics.

A tramp is not a hobo; a hobo is not a tramp; a vagrant is neither; a criminal is none of these.' The crowd seemed to be a little surprised at these remarks, and Mr. Bailey explained that he was at one time a member of the profession, and probably understood the matter as well as anyone else, and he took the time to explain their different characteristics.

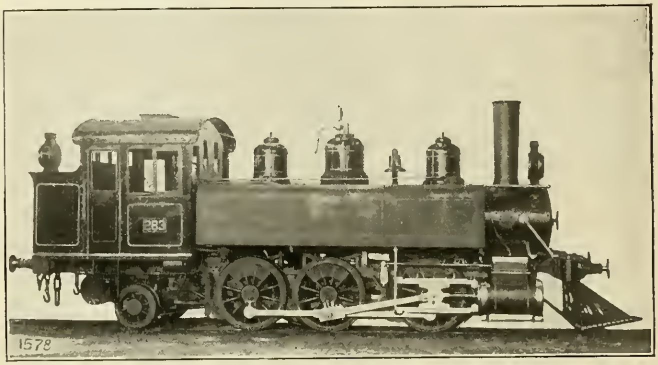
"'On railroads where engines are handled in any other way than by regular crews, it is indiscriminately termed pooling, they, failing to make distinctions where great differences exist. For example, we will say, an engine that is regularly crewed has a certain dignity that is maintained by the enginemen on that engine, and the shop forces, from the ash pit to the back shop, feel that there is someone looking after the needs of that particular engine, who will make complaints if necessary when the work is not properly done; in other words, the individuality of the regular crews on that engine is shown by the care that is taken of the engine by the round-house force.

"'When the management finds that the service can be improved and the traffic handled more economically by pooling engines, the dignity of the engines must necessarily be maintained by the mechanical department, instead of by the engine crews. When the engine arrives at the terminals they are turned over to the mechanical department, leaving it for them to say when the engines are to be ready for service. This method has always been successful wherever adopted. But there are times on most railroads, if business is good, when the transportation department takes the matter into its hands and states how long it should require to get an engine ready for service after its arrival; the mechanical department working under the impression that they are paid to obey orders, will send the engine out at the expiration of that time, whether necessary repairs have been made or not. This is what is termed "chain ganging," and should not be counfounded with pooling, because chain gang engines lose that dignity that the mechanical department gives to pooled engines, also that dignity that regular crewed engines get from the enginemen, so that the employees from the ash pit to the back shop, including the enginemen, has little, if any, respect for the chain gang engines.

"'When the railroads who have not yet done so, begin to agitate the pooling question the engine crews are decidedly against it, because they are more or less familiar with the results on roads where the engines have been chain-ganged, and they are unfortunate enough never to have come in contact with a successful pooling system.'

BALDWIN LOCOMOTIVE FOR CUBA.

Engines will reach certain stages which can be described as Mr. Bailey has described the different castes of the tramp species. The properly pooled engine will represent the prominent citizen who lives in his own home and assists, by paying his taxes, in taking care of the more unfortunate or lower classes of mankind. The chain gang engine will represent the hobo, who, in a manner, works when necessity requires, but is not able to attain satisfactory results. This engine reaches a point where it becomes a gratter, laid up near the roundhouse or back shop with a cracked firebox or broken cylinders, and tells pitiful tales of former brilliant prospects. You will see that, if the chain-gang engine is turned over to the mechanical department and they are allowed to do the necessary work when needed, it would immediately become a pooled engine and a certain dignity would be restored that was absent during the time it was in the chain-gang.



SIX COUPLED TANK LOCOMOTIVE FOR CHILI.

Locomotives for Chili and Cuba.

Among the locomotives recently shipped by the Baldwin Locomotive Works are some for the Spanish-American Iron Company, whose mines and plant is at Diaquiri (Santiago Province), Cuba, made somewhat famous by the late unpleasantness with Spain. They are standard gage and of the type generally known as the "Prairie," which seems to be gaining in popularity for freight service. It is generally adapted to allow of a wider firebox than can be placed between the wheels, but does not seem to be the consideration in this case as the box is only 33¾ inches. Dimensions follow:

Cylinder—18 inches x 24 inches.

Boiler—Diameter, 56 inches.

Working pressure—160 pounds.

Fuel—Soft coal.

Staying—Iron crown bars.

Firebox—Length, 89 11-16 inches; width, 33¾ inches.

Tubes—Number, 200; diameter, 2 inches; length, 12 feet 6 inches.

Heating surface—Firebox, 122 square feet; tubes, 1,300 square feet; total, 1,422 square feet; grate area, 21 square feet.

Driving wheels—Diameter outside, 50 inches; journals, 7½x8½ inches.

Engine truck wheels (front and back)—Diameter, 30 inches.

Journals—5x8 inches.

Wheel base—Driving, 11 feet.

Total Engine—26 feet 7 inches.

Weight on driving wheels—81,640 pounds.

Weight on truck, front—16,750 pounds.

Weight on truck, back—12,850 pounds.

Weight total engine—111,240 pounds.

Weight total engine and tender—173,000 pounds.

Tank capacity—3,000 gallons.

The Chilean six coupled engine uses the rear truck to carry the overhang of attached coal tank, water being carried in the side tanks beside boiler. It is a 5 foot 6 inch gage, has European buffers and carries two sand boxes as shown. The main dimensions are:

Cylinder—15 inches by 22 inches.

Boiler—Diameter, 40 inches.

Working pressure—160 pounds.

Fuel—Soft coal.

Firebox—Material, copper.

Firebox—Length, 40⅛ inches; width, 43 inches.

Tubes—Material, copper; number, 88; diameter, 2 inches; length, 12 feet 8 inches.

Heating surface—Firebox, 53.6 square feet; tubes, 577.6 square feet; total, 631.2 square feet; grate area, 12 square feet.

Driving wheels—Diameter outside, 45½ inches; journals, 6x8 inches.

Engine truck wheels (back)—Diameter, 28 inches; journals, 4½x7½ inches.

Wheel base—Driving, 9 feet 3 inches; total engine, 15 feet 6 inches.

Weight—On driving wheels, 76,885 pounds; on truck, back, 9,300 pounds; total engine, 86,185 pounds.

Tank—Capacity, 1,300 gallons.

General Correspondence.

Injectors and Strainers.

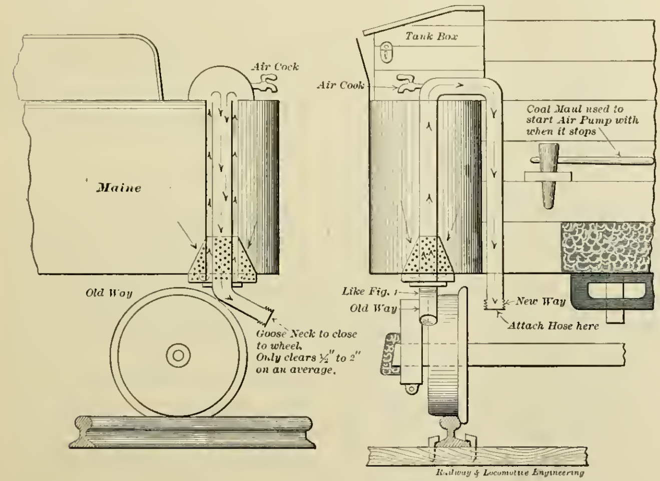
Improvements of most all kinds have been made on locomotives in the past 50 years but I see *none* in the way of taking water from our tenders made at the present time from 50 years ago.

The engineer comes in and reports "Injector no good," when in my 15 years' experience with all kinds of injectors I have found 99 failures out of 100 are due to the deplorable condition of our present method of taking water from the tanks. I inclose a couple of sketches, one of the old way as it is used at present, the other that I would like to see put into use.

The old way the goose neck is too *small* and too close to the wheel, only clearing ½ to 2 inches. There has been no less than 12 or 14 pair put on in this roundhouse in the last 3 or 4 months. I sent a man miles the other day to make repairs and both injectors went to work as soon as engine had steam without any repairs.

Another one comes in and can't work injectors (no good, of course). I got out and put it on first time trying. Found 3 old strainers up in goose neck. That conical strainer is the curse of the injector. Another one comes in and reports "injectors no good." Take down water hose but no water. Tank gate disconnected. Another one telegraphs to have injector ready to put on. Three injectors are tried by machinist but no water will enter the boiler on left side. Steam is blown off and boiler check looked at. About the time machinist is taking off check valve cap nut engineer comes along and says, "I forgot to tell you that there was a new man at the other end that put in a new check valve and he forgot to saw off the top end of valve so as to give it lift. The stem was doubled up where he used a 4-foot wrench to screw it down," said he. "I had to screw darn hard to get that cover on," and I thought so, too. Don't condemn the injector until you give it a little show.

I saw 3 different men work all night on the left side of an engine to put water in, and put in 3 different squirts. The trouble was finally located by putting my jack knife into the water hose and opening it the whole length. The lining was all rolled up into a ball. A new hose put the injector to work O. K.



TANK STRAINER FOR INJECTORS.

I would like to see the device shown in sketch tried. It takes the water out of the top of tank, and down on the outside close to the coal board through the floor of tender inside of the wheel, out of the way where a man can get to it to work. Throw away the strainer in the water hose and put a reliable one on the inside of tank I think your injector troubles will mostly disappear. Put a little oil in them once a week.

FRANK H. BRACKETT,
Foreman B. & M. Round House.
Nashua, N. H.

Delays By Snow.

I traveled quite a little last winter, and with few exceptions all the delays have been caused by the snow blocking the "points" or switches in the yards. On one through train, we traveled right along between cities, but lost time at every point by switches being blocked with snow. On one suburban road this trouble piled up trains all along the road, when the only block was at the terminal.

There is a chance for some bright genius to make a good thing by preventing this. The old "butt" end switches (which, by the way, replaced the "points" not so many years ago, but fashion has changed again) did not give as much trouble in this respect because there was more chance to clear themselves. It's an opportunity for big improvement.

I. B. RICH.

Large vs. Small Locomotives.

In referring to a problem presented by Mr. F. P. Roesch in April ENGINEERING, under the title of "Large vs. Small Locomotives," the writer will not attempt an explanation from his standpoint, especially, Mr. Editor, as you confess being puzzled by it.

One might properly, I think, suggest from the data afforded that the large locomotive was not worked to full capacity, that purposely the maximum tonnage desired per train regularly only was given. With equal steam pressure we should reasonably expect the best relative result from the engine best proportioned for heavy work.

Close observers in locomotive practice, some of them at least, have a growing opinion that 180 pounds to 185 pounds steam, in the case of single expansion locomotive, is the economical limit of pressure, and, where increase of work is desired it will afford best result to provide cylinders, wheels, stroke and heating surface, for this pressure. In this view of the case, the small locomotive was the best equipped for its share of the hauling test but, possibly, the result would be reversed if the large engine should be given 180-pound steam only, and be worked with equal care, to full capacity.

The practice on one of the large Eastern lines favors single expansion 180-pound pressure engines, and, in its later build of engines, with large cylinders, well proportioned boilers, etc., they get excellent results. Fortunately, this is not a question between compound and single locomotives, and we may thank Mr. Roesch for his presentation of it in suggestive form.

GEO. W. CUSHING.
Chicago, Ill.

There is talk of moving the principal division offices of the Santa Fé from Topeka, Kan., to Emporia. The people of Topeka are opposing the change, but that will not have much influence.

Another Way of Rating Locomotives.

The change that has taken place in locomotive statistics during the past few years has opened such a broad field of possible ways and means of showing results as to raise a question in regard to the depth to which it is desirable to delve into figures, economy and efficiency both considered. The ton-mile system is the outcome of a grand conception but we sometimes forget the object to be attained, and wrestle with problems that are without foundation. Among the various results sought, an important one is to ascertain which are and which are not the economical engines and enginemen. To do this we consolidate the individual performances for an entire month and under a great variety of conditions, which is absolutely destructive of comparison; both between the performance of different men, the performance of one man during different periods and the performance of classified locomotives. After spending a great deal of money to compile figures, it is not known how much coal should be sufficient to haul a certain tonnage between specified points, and it would seem that the only way to get the exact facts is to compare the performance of an engineman on a particular class of engine, over a particular piece of track, in the same direction and under like conditions. It is inaccurate to consolidate the figures showing a man's performance during an entire month regardless of climatic conditions, and equally inaccurate to consolidate his performance upon different classes of engines or on different schedules. An elaborate statement may be the result of carefully compiled figures, and in appearance be a work of art; indeed it may carry sufficient weight to make a general manager fretful or flush, according to the circumstances, and still be founded upon the grossest inaccuracies; built up from deceptive fundamental figures.

It would be cowardly to criticise present methods without at least hinting at something for a substitute. Would not a record of a permanent character be of more value? For example: An engineer is credited with a certain number of ton-miles per pound of coal, after hauling a train from Buffalo to Cleveland in good weather. Make a permanent record of this, noting the temperature, number of train, etc. The next time he runs from Buffalo to Cleveland, record his performance in the same place, if all conditions are the same. Otherwise open a new account with him, noting all conditions. If this is done with all engineers running over that particular piece of track, the record will soon demonstrate what can be done on a certain class of engines between the two points going west, and engineers who continually fall below what is accomplished by other men under similar conditions, will be positively known to be inferior and in need of instruction. The cost of keeping a permanent record would be much less than making expensive statements to be filed away each month undigested, and from the record could be ascertained not only the comparative performance of enginemen but the most economical classes of engines in service.

In attempting to produce results by comparison, basic principles should be without fault, and the most substantial basis upon which to build is comparison founded upon figures obtained under circumstances in all respects uniform. One of the first embarrassments that presents itself is the difficulty in obtaining accurately the amount of coal upon a tank before and after making a run. This can be done with a greater degree of accuracy than is done under present conditions, particularly where the issues are made to balance with receipts at coal sheds by manipulating the figures. General fuel accounts and accounts showing individual performance should be completely divorced. An engineman should receive every pound of coal charged against him, and the computation should not be rendered valueless for comparative purposes by including fuel consumed at round-houses. The amount of coal put on a tank, can, of course, be ascertained with reasonable accuracy without weighing, and the one essential to get the amount of coal consumed per trip, is a way to find out how much coal remains in a tank at the end of a run. This can be done by having ribbed lines on the sides of tanks at about the slope usually presented by the top surface of coal remaining at the end of a trip, so spaced and marked that the amount of coal remaining will be definitely indicated. If some slight alteration in the construction of tanks should be found necessary, the expense would be justifiable, if by doing so accurate figures can be obtained.

The thing greatest to be desired is a substantial basis, and however illogical methods that differ from present practices may seem, it must be admitted that perfection is remote in a matter vital to the interests of railroad companies.

A. D. Eigenbroadt.

Lincoln, Neb.

Shall Rods Be Put Upon Dead Engines?

Your statement concerning the putting up of side rods in transporting new engines is not entirely in accordance with the views of men that have the engines directly in charge, and I doubt very much if even theoretically correct.

I am aware that considerable damage has been done to the roadway of certain roads, and that some master mechanics insist upon rods being on; but if these M. M.'s were to ride a few of the dead engines they would find the trouble existed, not in the rods being off, but from the fact that the head man is giving "that fellow" a ride, and that the time between mile posts is 1 minute 15 seconds to 1 minute 20 seconds. To these figures the writer will swear.

Now, do you think an engine balanced when only side rods are on, with pistons and main rods not coupled? Well, she is not, and lacks considerable of being, in fact all counter-balances being "in-step," strikes a harder blow, and if wheels are left uncoupled nine miles out of every ten are made with wheels "out of step," thus reducing blow.

And again, new engines are always shipped with wedges very loose, and we all know what becomes of rod bushings under such circumstances; furthermore, one man has two engines. Some of our Western roads will make 80 miles with only one stop, should a pin get hot on the engine that no one is on, what will be the condition of pin when engine stops?

No, Mr. Editor, it is not justice to either the firm that builds the engine or company receiving same to ship them with rods up. Curtail the speed to that which is reasonable, and the track will not suffer—neither will the new engine.

John Frost.

Kansas City, Mo.

To Locate Blow in Valve Strip.

I have often read with interest in these pages, of the different ways different men had of locating the trouble when a balance strip in valve drops down or is broken enough to blow.

I have tried many ways, but think the following the simplest, and as I have never heard of it before think I can claim originality.

When I first feel that peculiar tug at the reverse lever when a strip drops down, I take hold of lever and note position of cross head when the jerk takes place, if it is at top and bottom quarter on my side the trouble is there, but if it takes place as engine passes centers it is on the opposite side, for the reason that the jerk comes just at the instant the valve starts on its return travel, forward or back, which occurs close to the bottom and top quarters.

A dry valve, or too tight valve stem packing, may be located in the same manner.

If the least bit in doubt as to which side trouble is on, I stand engine on top or bottom quarter on either side, set brake, admit a little steam to cylinders, and work reverse lever back and forth. If it should work hard I know the trouble is on that side, whichever side lever works hardest on when engine stands on quarter on that side is the side where trouble is.

Frank L. Street,

Neodesha, Kan. "Frisco System."

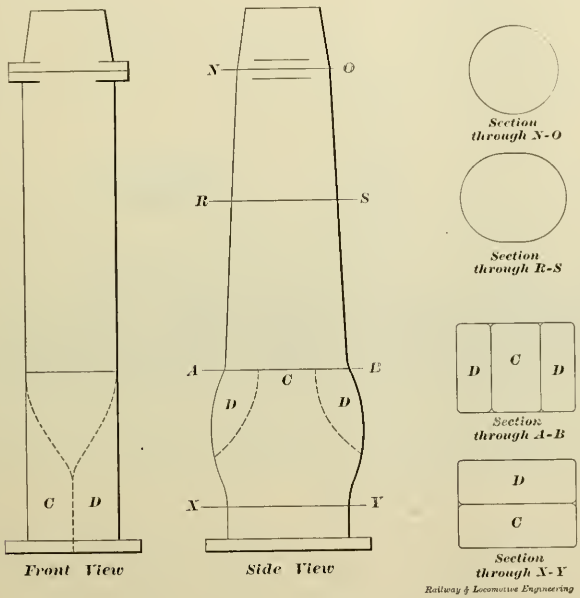
An Exhaust Nozzle That Will Not Cross-Fire.

Some engineers object to the single nozzle on account of cross-firing of the exhaust, which is supposed to interfere with the draft. To prevent this difficulty I submit the accompanying sketch which does not require much explaining.

The section view through XY shows that one cylinder discharges into C, the other into D. The passage C goes up the center after leaving XY and D divides into two parts DD and discharges each side. The exhaust pipe gradually charges into a round section as shown, being of the usual shape and size for a nozzle at N O.

It can be made easily, being merely a matter of casting with cores of the right shape. HENRY FRANKLIN.

Scranton, Pa.



AN EXHAUST NOZZLE THAT WILL NOT CROSS-FIRE.

Reported Work; Be Fair to the Engineer.

I wish to say a few words to machinists working on repairs in railroad service, to our young ones and some of the old ones. I will suppose that the engines on your system are pooled, and that Engineer Smith has reported injectors will not work on engine No. 009. Now, when you go to this engine to do this job you should try the injector and see what the indications point to as the cause of trouble with this injector, since it does not work as it should. Do not go through the injector by taking it apart without first trying to find the cause of failure, for, if you do, you will sometimes send the engine out on the road with the defective injector not working, and an important train hitched on. Now, the road is not the place to experiment with such troubles since they cause delays to train service. The round house is the place for this work, and the repairman is the man to do it, and should understand his business well enough to locate trouble without the engineer writing out instructions for him to work to, as there are a great many causes that will give the same indications. I also think that a machinist that will let a job go out without knowing it is O. K. should be disciplined as well as an engineer for failure through neglect of duty. It is very common for repairmen to do these jobs as reported by the engineer without signing work-book as having been done, and letting engineers do this work on the road, thereby delaying the service. The majority of engineers of to-day are intelligent enough to do some of the work required on the road.

C. W. GRAVESS.

Counterbalance.

It seems to be admitted that the hammer blow exists and the advent of the latest Baldwin engine marks the recognition of the "balanced" type of locomotive. Those of us who used to poke fun at Henry F. Shaw and the balanced engine named after him, as well as the fearful and wonderful Strong balanced compound, must acknowledge the corn and admit they were ahead of their time.

But before entirely giving up the ghost I want to have a little say on the counterbalance question. I believe that counterbalancing has been overdone, but perhaps the first step in the reform would be to lighten reciprocating parts still more, if that is possible. It is generally admitted that there is practically no trouble from the revolving parts which can be balanced nicely. The hammer blow comes from the extra counter balance which is put in to counteract the reciprocating weights—and it fails in its mission. There are two plans open. One the French scheme of balancing with a pendulum or "bob" weight, as shown in some of the engines at the Paris show, and simply balance the revolving weight in the wheels. The other is to decrease the amount of excess counterbalance over revolving weight and take up the "fore and after" motion by springs in the couplings between engine and tender. I believe this can be done to a large extent, and much of the trouble done away with.

There is no question as to the balanced engine doing the business, but it's an expensive remedy, and perhaps allopathic doses of homeopathic remedies might be effective at lower cost.

FRANK C. HUDSON.

Tombstone, Ariz.

More About Lead.

Can you definitely settle in my mind why they give a locomotive valve's lead, for this is a matter I have given no little thought and study. I have asked every person I ever had any reason to think that could tell me, and their answers are so different, non-specific. I have referred to all books that I have ever seen, touching on the subject. I have asked men in different railroad repair-shops, putting up the valve motion, the same question, and it is the same old answer, to make the engine smarter. An early admission gives an early cut-off. An early cut-off is economy. It allows the cylinder to use the steam expansively. Expansion reduces the back-pressure from the cylinder to the nozzle, when the cavity of the valve connects the admission and exhaust ports now by the valve opening their respective admission parts, allowing steam at steam-chest pressure to enter the end of a cylinder before the piston has completed its stroke toward this entering steam makes its smarter. I cannot see it that way. Some people can't learn; some will not if they could. Nature has never gifted me with either of those two dispositions. The old argument is that by this method the engine is helped off of her dead center. That is true, but is not the engine deprived of the same amount of help nearing the

end of the stroke by cushioning against the steam being admitted in the face of the advancing piston? These early admission advocates that put up their *quicker* arguments do not explain why the same engine will act, or be smarter, 4 or 6 months after she has been out of the shop after the engine has created, or worn sufficient loss motion from the eccentric to the valve to wear off their lead. The most able article I ever saw on this was in one of your numbers, but the question did not cove. the point. In my mind I still adhere to my same opinion, that lead is given a locomotive to cushion her parts and rest her machinery.

J. N. Keller,

Lock Haven, Pa.

Simple Way to Show Hauling Power of Engines.

The tractive power of a locomotive being the only standard for comparing hauling capacity of engines, some simple method is required for comparing tonnage to insure a uniform load for engines differing in size. To divide the tractive power in pounds by the resistance in pounds of one ton gives maximum tonnage an engine can haul using full power and at low speed. The result thus obtained is of small value, as engines cannot haul this tonnage in regular service. As a basis for comparing tonnage of different sized engines, and to compute readily what new or proposed power will haul, the following method is proposed:

Take as a basis of comparison some engine in regular service whose performance is satisfactory. Divide tonnage for all points on a division by tractive power in 1,000 pounds. This gives number of tons hauled per 1,000 pounds tractive power as a constant. To obtain tonnage of any engine, multiply constant for each grade by tractive power of engine in 1,000 pounds. For example, Boston & Maine Railroad, Fitchburg Division, Eastern Section. Engine 34,000 pounds tractive power used as basis:

	Tonnage.	Tons hauled 1000 lbs. T. P.
E. Deerfield East.......	1050 ÷ 34 =	31
E. Fitchburg East......	1700 ÷ 34 =	50
Boston West...........	1150 ÷ 34 =	34
E. Fitchburg West.....	800 ÷ 34 =	23.5

Example: To find tonnage from these points of engine illustrated on page 33, January issue. Tractive power, 43,000 pounds:

E. Deerfield East....	31 × 43 = 1333 tons.
E. Fitchburg East...	50 × 43 = 2150 "
Boston West........	34 × 43 = 1462 "
E. Fitchburg West..	23.5 × 43 = 1000 "

To apply the above rule, have the tractive power of all engines on the division in table form opposite the class letter. Then in times of congested traffic it is very easy to compute tonnage of passenger engines, or engines from other divisions, the tonnage of which is unknown.

Walter S. Hutchins.

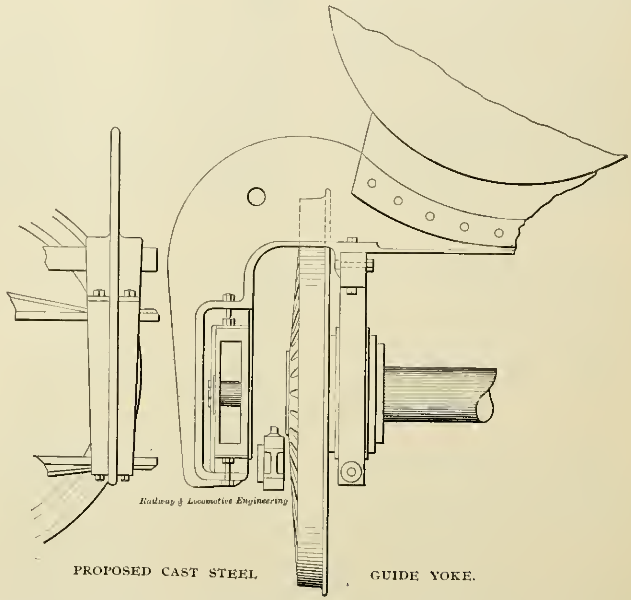
Troy, N. Y.

Proposed Cast Steel Guide Yoke.

A lot of new Mogul engines for the Maine Central have the type of crosshead illustrated on page 63, by the New York Central Consolidation, necessitating a strap on front side rod. I consider this a weak detail, and would here suggest a guide saddle of cast steel, open in back, as shown by accompanying sketch, to permit of the use of solid front and side rods.

Frank Rattek.

Manchester, N. H.



PROPOSED CAST STEEL GUIDE YOKE.

Inspection of Engines in the Pool and Out.

Virtually all engines on most of our western roads are in the pool; but on some roads, certain districts are in the pool by official decree, and in other districts of the same road, the pool exists by circumstances.

Now there is quite a difference between the two kinds of pool mentioned. The pool that is formed by official decree takes a large part of the responsibility of caring and inspecting of the engines from off the shoulders of the engineers and places it, in a manner, on the roundhouse foreman and his corps of assistants. Of course the man in charge of the incoming locomotive must have a summary of such work that he is expected to keep up, such as rod work and defects noticeable in the general working of the engine, defects in the valve motion, blows and pounds, anything running hot, or journals heating, and engines not steaming. In fact, anything that is not likely to be found out by the engine inspector. Of course the above work would fall on the engineer, inspector or not.

The inspectors located at terminals are supposed to make a rigid examination of all parts of the engine, frames, springs, eccentrics, nuts and bolts, fire bars, pedestals, and in fact, everything about the machine and its tender. Now, this inspector by official decree lends a greater degree of safety to our locomotives, and of course to the men who are running them. This, of course, saves time and annoyance on the road, as chances for a breakdown are reduced to a minimum by careful inspection. You will sometimes find, no matter how close our engineers inspect their engines, some little thing will be overlooked, owing to the position the engine stands, which will be discovered later on by the inspector, after the engine is in the house. I think as a rule most of our engineers are conscientious in looking over their engines, but there are times when something is overlooked, but is found later by the inspector, and the old saw "that two heads are better than one" applies here very nicely.

The pools formed by circumstances are entirely different, and are caused by a shortage of motive power. The consequences are that the motive power on every division, where such is the case, is virtually pooled. This is to the disadvantage of the men who are in this ter-

ritory. For instance, the engine that comes into the terminal is the only one in there. The side tracks and yards are blocked with loads waiting to be moved, and this engine is wanted for service as soon as it can be had. It is out of the question to expect the crew that came in on this engine to go back, for it is very likely that they have been from twenty to thirty hours on the road already. So this crew is replaced by a crew from the extra board.

Now this is kept up from one week's end to another, the men assigned to the engines making a trip and losing a trip. The engineers are frequently assigned to regular engines, but the extra men make most of the money on them. Now this is what makes a pool by circumstances, over which the men have no control, but the responsibility is just the same, and to my belief, greater than where the pool is official, as in the first mentioned pool, where the engines get the benefit of inspection, while in the last named pool the engines don't. The men running the last engines named are supposed to be their own inspectors and are held entirely responsible for the condition of the engine.

It is quite frequently the case that the men hardly ever get the chance to properly inspect their engines by having them in the house over the pit where the inspection can be made thoroughly. It is a noticable fact that when business is dull, and the men have plenty of time to attend to the engines assigned them, that engine failures are very few; but when business is rushing and motive power gets scarce, the number of engine failures increases to an alarming extent.

The reason for this can very readily be seen. Between the two extremes I think it is necessary to have engine inspectors for all engines, not to take any of the care and responsibility off of the engineers, but for the betterment of the service at large, especially when business is such that it keeps every one connected with the Transportation Department guessing whether this or that engine will make a successful trip or not. This would be a good subject for the consideration of the Traveling Engineers' Association when next they meet.

Neodesha, Kan. EMIL SCHMELDEN.

Additional Information About the Lancaster Locomotive Works.

I have been very much interested in your articles on locomotive building in the United States, and especially in the March number, where you speak of the Lancaster Locomotive Works at Lancaster, Pa., as the writer was an apprentice in these works from Oct., 1865 to Oct., 1868.

None of your articles, however, speak of the Brandt Locomotive Works which were in Lancaster, Pa., previous to the Norris Brothers having control of these works.

The Brandt Locomotive Works was started in Lancaster, Pa., in the early part of 1853. It was a stock company. They were operated until the fall of 1857. During the panic of that year they failed, the cause being, that they had built a great many engines for the Southern States, and when the panic came they could not get the money for them. The General Superintendent was John Brandt, Sr. He had two sons who worked in the shops at that time. John Brandt, Jr., and Abe Brandt.

John Brandt, Sr., died a number of years ago, leaving quite an amount of property in Lancaster County to his two sons. About 1870 or 1871 the two Brandt boys drifted out to Oregon and started to build the Oregon and California Road. This is now part of the Southern Pacific. John Brandt, Jr., was General Superintendent of this road, and died a few years ago at the Palace Hotel in this city. Abe Brandt was the master mechanic of this road, and died about four years ago in Portland, Ore.

The Brandt Locomotive Works built a great many engines for the P. R. R. Co., or rather for the State, as the State of Pennsylvania owned this road up to about 1856 or 1857. Of course the engines were all named at that time, and the writer can remember most of the names since he was quite a small boy. Following you will find some of the names and numbers, which may be of some interest to you, and the readers of the RAILWAY AND LOCOMOTIVE ENGINEERING.

These engines had the cylinders on quite an incline; the valve seat was on the same incline, forward and back; but standing on the side of the cylinders, the seat was higher on the inside than on the outside, so that when a man had to face the valve seat with hammer, chisel, file and scraper, he had to work up hill. There was also a brass plate on the end of each driving axle, on which was inscribed the Lancaster Locomotive Works, J. Brandt, Sr., General Superintendent.

While the writer was apprentice at these shops, under the Norris Brothers, these engines went by every day on both passenger and freight trains.

The writer saw the engine called "Fingall's Baby" No. 188, on list sent you, still running on passenger trains during the Centennial year. Engine "Wheatland," No. 166, is the engine that hauled the Prince of Wales from Pittsburg to Philadelphia in 1860.

When the writer went on the Pan-Handle in 1869 and 1870, there were four of these Brandt engines running there between Pittsburg and Columbus, Ohio. They were numbered 12, 13, 14, and 15. The 12 was the "Jewett," the 13 was the "Means," the 14 was the "Cincinnati," and the 15 was the "Godfrey Heck." The last one, the 15, had double domes. These engines were still running there when the writer left there in 1881. Perhaps Mr. Fred Nellis could tell when they were scrapped, as he worked there for several years afterward.

After the panic of 1857 these shops laid idle for a number of years. At one time the Pennsylvania R. R. offered to buy them, but the company wanted too much for them, and the Pennsylvania company built their shops at Columbia, Pa.

Some time in 1863 the United States Government closed up the Richard Norris & Sons' shop in Philadelphia, for the reason that they had refused to do Gov-

Photo by Elmer Chickering, Boston.

PRINCE HENRY'S TRAIN IN BOSTON.

ernment work. Edward and James Norris, two brothers of Richard Norris, came to Lancaster about the same time and leased the old Brandt shop for a year, with the privilege of buying it when the year was up. They got some very good contracts and at the end of the year bought the shops outright. About this time James Norris died, and Edward Norris ran the shop afterward.

When the writer went into the shop in October, 1865, they were then building a number of engines for the Western Pacific R. R. of California. These engines had to be all boxed up and were sent around Cape Horn in sailing vessels. Five of these engines are still running here on the Southern Pacific. At that time Mr. Fred Currie was General Superintendent and Wm. Norris, Ed Page, and Cole Stump were the draughtsmen.

Edward Norris made a fortune for himself and the family of James Norris, but it was lost and spent, and finally in the fall of October, 1868, the works were closed down, and one banking firm in Lancaster was involved for a considerable amount of money.

In 1869 a man by the name of Tyng came to Lancaster and persuaded this banking firm to start the works up again, to try and get their money out of it. It was called the Tyng Locomotive Works, and after running about a year, and building a few engines, mostly for the Pennsylvania R. R., the works were closed down for good. Some of these engines were afterward sent from the Pennsylvania R. R. to the Pan Handle. For a number of years these works have been called the Pennsylvania Rolling Mills and have been making railway supplies.

ENGINES BUILT BY THE BRANDT LOCOMOTIVE WORKS FOR THE PENNSYLVANIA RAILROAD.

NAME.	No.	DIAM. & STROKE OF CYLINDER	DIAM. DRI.	TOTAL WT.	WT. ON DRIV.	DATE BUILT	SCRAPPED
Keystone........	159	16 in. x 22 in.	60 in.	57,200	35,000	June, 1853	1877
Conowingo	160	16 in. x 22 in.	60 in.	53,000	31,800	July, 1853	1884
Utah............	161	16 in. x 22 in.	60 in.	57,800	37,800	July, 1853	1869
Minnesota	162	16 in. x 22 in.	60 in.	57,100	35,100	Aug., 1853	1884
Clearfield	163	16 in. x 22 in.	60 in.	53,000	31,800	Sept., 1853	1869
Clinton	164	16 in. x 22 in.	60 in.	53,000	31,800	Sept., 1853	1876
Atalanta.........	165	16 in. x 20 in.	66 in.	55,200	33,200	Sept., 1853	1884
Wheatland......	166	16 in. x 20 in.	66 in.	55,200	33,200	Oct., 1853	1869
Shanghai........	172	16½ in. x 20 in.	66 in.	56,800	34,300	May, 1854	1869
John Gilpin......	175	16½ in. x 20 in.	66 in.	56,800	34,300	June, 1854	1877
Tam o' Shanter..	176	16 in. x 22 in.	60 in.	57,200	34,200	Dec., 1854	1877
Uncle Toby.....	177	16 in. x 22 in.	60 in.	57,000	34,200	Jan., 1855	1876
Bardolph........	178	16 in. x 22 in.	60 in.	57,000	34,200	May, 1855	1881
Old Fogy........	179	16 in. x 22 in.	60 in.	59,400	34,600	May, 1855	1869
Young America.	180	16½ in. x 22 in.	60 in.	58,400	36.000	Oct., 1855	1881
Attila...........	181	17 in. x 20 in.	60 in.	59,200	34,200	Dec., 1855	1879
Alaric...........	182	17 in. x 20 in.	66 in.	59,200	34,200	Feb., 1856	1875
Toney Weller...	183	16½ in. x 22 in.	60 in.	58,400	36,000	Feb., 1856	1869
My Son Samuel.	184	16½ in. x 22 in.	60 in.	58,400	36,000	May, 1856	1882
Yorick	185	16 in. x 22 in.	54 in.	53,000	32,200	Mar., 1856	1874
Alert	186	16½ in. x 22 in.	60 in.	58,400	36,000	Apr., 1856	1884
Corporal Trimm.	187	16 in. x 22 in.	54 in.	53,000	32,200	Apr., 1856	1875
Fingall's Baby..	188	18 in. x 22 in.	60 in.	66,000	39,600	June, 1856	1875
Falstaff	189	18 in. x 22 in.	60 in.	66,000	39,600	June, 1856	1870
Buchanan	193	18 in. x 22 in.	60 in.	66,000	39,600	Aug., 1856	1870
Hiawatha......	194	16½ in. x 22 in.	66 in.	60,000	35.000	Feb., 1857	1882
Breckenridge....	195	16½ in. x 22 in.	66 in.	60,000	35,500	Feb., 1857	1882

The next contract we had was a number of engines for the P. & R. They were ten wheelers and were called Milholland Gun Boats. There must be a number of this style of engine still running on the Reading Road. The boilers had two domes, the cab was made of sheet iron, and the boiler extended back and downward from the cab, something on the style of the old Ross Winan Camel Backs.

In 1866 Mr. John A. Durgin was appointed Constructor and General Superintendent of these works. We built engines for the Pennsylvania R. R., Allegheny Valley and a great many other roads. In 1867 the first two Decapods were built, and were designed by Messrs. Mitchell and Durgin. We afterwards built some very heavy engines for Mr. Milholland, who was then master mechanic on the Cumberland and Pennsylvania Road.

In regard to the Portland, Maine, Locomotive Works. The writer was sent to Oregon and Washington in 1881 to the Oregon Railway and Navigation Co., and the Oregon and California R. R. to equip their passenger trains with the Westinghouse Automatic Brake. At that time the O. R. & N. and the Pacific division of the Northern Pacific from Kalama to Tacoma, had a number of these engines, but they were not thought to be much good, as they would not stand the hard knocks on a western railroad, and at that time when the rails were laid upon top of the ground. As the heavy engine has come into use since then, I suppose that they have been relegated to the scrap heap years ago.

I do not know that all of this detail will be of much use to you, but as I started to write, I got into thinking over the old times, and probably put a great deal into this letter that no one will care about reading. If that is the case put it into the scrap basket.

HENRY C. FRAZER,
Traveling Inspector for the Westinghouse Air Brake Co., on the Pacific Coast.
San Francisco, Cal.

Cutting Off the Transportation Privilege.

The Eastern trunk lines are not standing out so grimly against the giving of free transportation to railroad men as they were at the beginning of the year; but the sentiment which they have spread against the granting of transportation is likely to exercise a thinning influence upon attendance at the railway mechanical conventions in June. There will be important business to transact at both the conventions this year and we believe that most of the railroad companies will encourage their machinery department officials to be present, but any obstacle thrown in the way of free transportation is certain to reduce the number of railroad men at the conventions. In a few instances railroad companies may pay the expenses of the head of their mechanical department, including transportation charges if necessary; but the chances of division men having their expenses paid is very remote and after all it was the division men who swelled the conventions to moderate proportions and it was they who frequently took the most active part in the proceedings and they always contributed valuable ideas to the discussions. A convention without division master car builders and division master mechanics will be a very tame affair.

Those who were responsible for taking away the privilege of granting transportation to railroad officials on their way to and from metings where questions relating to railroad matters are to be discussed, hit a harder blow to railroad interests than they did to the men whose usual privilege has been cut off; at the same time an aggravating slap has been given to a class of men who deserved better treatment. Attending the mechanical conventions has been made the occasion of a short holiday for men who enjoy no relaxation from toil and oppressive responsibilities during the remainder of the year. Hard work and no play makes Jack a dull boy and railroad companies are not likely to profit by this move which keeps a chronically overworked class of men at home all the year. We hear a good deal nowadays about *esprit de corps* among employees of railroad companies, and the advantages that accrue from harmony and emulation to make the company more respected than any other. Cutting off such small privileges as a pass annually is not likely to make railroad companies stand in a heroic light with their employees.

The New Commissioner-General of Immigration, Frank P. Sargent.

Born and reared in the little village of East Orange, up in the green hills of Vermont, he finished a course of instruction in "readin', 'ritin' and 'rithmetic" at the district school of his native village, and left the old home at the age of seventeen to seek his fortune in other lands. Beginning his career in Manchester, New Hampshire, as an apprentice to a photographer, he soon learned the art of pleasing the public by making portraits that looked handsomer than the subjects.

The life of an artist did not prove agreeable, however, and longing for a more active life he enlisted in Company D, Sixth United States Cavalry, and in a short time had his dreams realized with all the activity he desired.

He was located at Fort Apache, Arizona, under the command of Captain E. G. Hentig, and in the summer of 1880 was engaged in Arizona and Mexico pursuing the then famous Victoria and his band of bloodthirsty Apaches. Obtaining an honorable discharge from the service in November of the same year, he drifted into Tucson, Ariz., then a new railway town. It was there that Mr. Sargent's railroad career began. He applied for and obtained an official position with the Southern Pacific Company. The position, while not exceedingly remunerative, was in a field that permitted rapid advancement, and he was appointed wiper at the Tucson roundhouse. Three months later saw him firing a work train engine, and shortly thereafter he went into regular road service.

His ambition was to wear a Brotherhood pin, and just eleven months and nineteen days after he entered railroad service he was initiated in number 94's lodge room, which at that time was a coal bin near the roundhouse. He was an enthusiastic member and chronic kicker from the start, and the interest he exhibited in the welfare of his fellow workmen led the lodge to intrust to Brother Sargent's care many of the duties that always go to those members that love the Brotherhood and are ever ready to speak a word in defense of a brother. He attended the Terre Haute convention as 94's delegate in 1882 and immediately made a favorable impression upon his associate delegates. The following year he attended the Denver convention, and was elected Vice-Grand Master. In 1885 at Philadelphia he was elected as the chief executive of the Brotherhood, and the fact that he has repeatedly succeeded himself, indicates with certainty that he has proved true to the trust reposed in him.

The keynote of his success as a labor leader and of his selection as Commissioner-General of Immigration was that he studied both the demands of the workingman and the counter contentions of the employers and decided definitely and clearly what in his judgment would be a fair solution of the difficulty, and then worked indefatigably to secure such a settlement.

"Sargent is daft on being fair. What we want is to tie up this road and make the Vanderbilts dance to our music," exclaimed an agitator at a meeting of New York Central firemen during the great railroad strike in 1894, when the hotheads would have paralyzed pretty nearly every railroad system in America, but

FRANK P. SARGENT.

Mr. Sargent steadily resisted their desire to strike, and gained his point—and ultimately the gratitude of the men whom he saved from a serious false move.

Fairness of labor to capital may be set down as Frank P. Sargent's fundamental rule of action, and so wedded is he to this principle that it amounts to a hobby, and it is probably for this that President Roosevelt has selected Mr. Sargent to be Commissioner-General of Immigration, and to better the conditions that prevail in that important department of the public service.

Mr. Sargent has always been a strong conserving influence. He never spoke in the language of the agitator, whose catch phrases he abhorred and condemned. He led the way in teaching organized labor to regard contracts made with employers as sacred and binding. He has argued that the rights of employers were to be respected, and that thus workingmen would gain more surely the recognition of their own rights.

President Roosevelt expects that Mr. Sargent will give the same patient personal attention to the reception of immigrants, and will see to it that all who pass through that great human clearing house at Ellis Island receive fair and kindly treatment. While Mr. Sargent may be depended upon to enforce the laws against undesirable immigrants, he will also put an end to abuses, so far as an energetic and indefatigable Commissioner-General can. He will not tolerate callous officialism, and the forlorn foreigner coming to grasp the outstretched hand of America will feel that there is a friendly welcome for him in the New World.

Correspondence Instruction by Telegraph.

A telegram received by the American School of Correspondence, Boston, Mass., from the superintendent of an electric plant in one of the sections affected by the recent floods, requested information regarding the treatment of dynamos that have been submerged. An answer was sent immediately by wire, followed by fuller details by mail, so that by the time the water had subsided enough to permit him to work, the superintendent knew what should be done. The American School has a Special Inquiry Department for answering practical engineering questions and the frequent requests for information, such as this, show how the privilege is appreciated by the students.

Last month the people of Chicago voted under the referendum system on municipal ownership of street railroads. The vote stood about six to one in favor of the public owning the street railroads. Municipal control of railroads has not worked well in this country, but it works remarkably well in some foreign cities. There is a growing sentiment in favor of the people in cities owning all franchises that are used to serve the people and the vote in Chicago seems to voice the sentiment. The day is probably not far distant when the people in cities and towns will insist on controlling lighting plants, water works, urban transportation and various other interests. It is a socialistic movement but it is advancing and the impositions that existing companies inflict upon the people accelerate the movement.

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The Practical Mechanic vs. The Mechanical Engineer.

We do not believe there is any class of intelligent men whose practical experience is calculated to eliminate foolish fads and fancies, that are so much given to following senseless fashions so blindly as railroad men. We are not going to begin criticising those who have proceded to adopt so slavishly certain fashions that are now prominent in the design of locomotives, fashions that have become popular on no more rational basis than the changes that come regularly over the architecture of women's head dresses; we are thinking of other prevailing fashions that have exercised disastrous influences upon the lives of a certain class of men and elevated another class into unexpected eminence. We refer to the fashion, that has come so much into vogue in the last few years, of appointing only college trained mechanical engineers to fill the position of superintendent of machinery of railroads. We have no intention of disparaging the value of scientific education for the men who fill the important positions at the head of the mechanical departments of railroads; but we cannot blind ourselves to the fact that men with purely mechanical training are nearly always of greater value to railroad companies than those who have been pushed into prominent positions by the force of scholastic attainments.

Knowledge of chemistry, of thermodynamics and of high mathematics are fine accomplishments for a superintendent of motive power to possess; but they are of little more practical value in the position filled than a knowledge of music or acquaintance with the dead languages. Senator Depew once made amusing remarks about a locomotive superintendent whom he met in Europe, who displayed a fondness for translating Greek verses; and the Senator seemed to think that the man would have been better employed studying how to make the locomotives under his charge haul passengers and freight at less cost, which was a very practical and rational view to take of the matter. Yet the class to which Mr. Depew belongs have fallen into the habit of advancing men to the head of the mechanical departments of American railroads because they possess educational attainments which are of no more value in working out the problems of moving passengers and freight at the least possible cost, than were the foreign railway man's accomplishments as a Greek scholar.

A superintendent of motive power has no occasion to apply high scientific knowledge to any of the duties he is expected to perform. If locomotives or boilers or cars have to be designed, the details are not worked out by a system of engineering reasoning concerning what forms and dimensions will produce the best results. They are worked out according to records of practice which have developed the best forms for the work to be done. The man who is ambitious to produce original forms, and puts them into steel and iron, nearly always comes to be sorry that he was not contented to abide by the established forms which had proven themselves successful. The principal duties of the head of the mechanical department of a railroad are to supervise the work of keeping locomotives and cars in efficient order at the least possible expense, and the training that will enable him to perform these duties with the greatest efficiency, is the training that will make him of the greatest value to the company he serves.

It is not our purpose in any way to underestimate the value of scientific education, for we have always urged young men engaged in mechanical pursuits to do all in their power to make any practical personal sacrifice to acquire the knowledge imparted in a college course; but we stand up to oppose the prevailing tendency to sacrifice practical experience and attainments every time that they come in competition with college graduates. Let us look a little into the kind of training calculated to prepare a man for performing high executive duties to the best advantage. If a college graduate goes through a real course of shop experience, then passes through the drawing office and performs the duty of a mechanical engineer, he may be fairly equipped to hold the highest position in the department; but his success will depend more upon habits of observation than upon his scientific training. The man who is purely practical and has learned most of what he knows of mechanical and engineering by practical contact with the work he has done will go to the top better equipped with practical knowledge if he acquired as keen observing habits as the other man. To a railroad official the knowledge that comes of observing habits is likely to be of much greater practical value than the knowledge acquired in a school or college. The shop man finishes his apprenticeship learning to do all kinds of shop work, and becomes a gang boss, then a foreman. These positions both develop habits of observation if the subject has a tendency that way. Perhaps he is made a round house foreman and has to diagnose all defects of locomotives, which we think is the best training in habits of observation that a man can go through in railroad life. Then he advances to be a division master mechanic, where he is responsible for the efficient performance of the machinery under his charge. In a few years he stands alongside the college trained mechanical engineer for selection for promotion. Who will say that the master mechanic is likely to prove a less efficient head of the department than the mechanical engineer?

Responsibility which the head of our mechanical department seems never to escape from, is taking the lead in finding out the cause of and remedying disorders that delay and demoralize train service. There comes an epidemic of engine failures and the management looks to the superintendent of motive power to go to the root of the defects and overcome them. It is the same with recurrence of hot boxes under passenger equipment. It is not enough that the superintendent of motive power should scold responsible subordinates, such as general foremen, master mechanics, and master car builders because defects of equipment cause delays; he must get down to the actual causes of the defects himself and hurry out the remedies. This is an instance where the broad, varied experience of the man who has plodded his way upwards through the different positions, is likely to be much better equipped for making difficult investigations than the scientific man who has enjoyed less practical experience.

An important part of the duties which the head of the mechanical department of a great railroad has to perform is, using means to keep the repair shops provided with facilities for doing work at the smallest possible cost. The duty frequently involves the decision to dispense with obsolete machinery, and the introduction of new methods. If the scientific

man has done sufficient shop work to enable him to judge if tools are turning out the amount of work which represents fair efficiency, and when the time has arrived that certain tools ought to be scrapped, he is likely to be more courageous in his decisions than the purely practical man who is probably more intimately wedded to ancient practices and entertains more sentimental interest in antiquated machinery than the scientific man. When questions of effecting radical changes in methods come up, such as the introduction of electric motors, the school man is likely to prove the more progressive of the two; but the shop man's judgment is likely to be of greater value concerning the efficiency of tools and methods in use, and as to how far changes could be economically carried out in the buildings in use. He is also likely to have much greater ability to direct the construction of new shop buildings and in the selecting of the tools by which they ought to be equipped. Both the purely practical man and the scientific man, are likely to have strong and weak points due to their peculiar training, and it is for the official making the appointment to decide which is likely to be the most value to his company as a whole; but the decision ought not to be influenced much by the fact that one of the men is a scholar and the other is not.

In writing of one being a scholar and the other not, we do not mean that the latter should not enjoy the advantages of an ordinary school education. Modern railroad presidents and managers ought not to be expected to appoint an illiterate man to the head of their mechanical department, no matter what his engineering abilities and acquirements may be. We have known men who could not write a grammatical letter and misspelled every third or fourth word run the mechanical department of a railroad satisfactorily; but that lack of mental endowments does not conform with modern ideas, and the appointing powers demand that the head of their mechanical department shall be able at least to make out a report at any time, written in a style that indicates a man with the equivalent of a good common school education, which is the inheritance of all ambitious Americans. All applicants for entry into railroad service are now required to prove that they have received the foundation of our English education; so it is only right that the heads of departments should be as well endowed.

Few of the railroad presidents and managers who have the appointment of men to the heads of the mechanical departments have enjoyed scientific education themselves, and on that account they are frequently disposed to overestimate the value of a college education for their subordinates. We think if they will give the question a little critical examination, that they will be more inclined to act fairly towards men who have learned in the heat and burden of the day to perform the responsible duties of superintendent of railroad machinery.

Leaky Boilers.

There are numerous theories concerning the cause and prevention of leaky boiler tubes and fire boxes, which have promised and effected relief in many instances when properly applied, but leaky tubes, cracked firebox sheets, and leaky staybolts continue to be conditions that remain persistently with railroad men, and those responsible for the efficient working of locomotives are so much burdened with the delays and demoralization of traffic due to those defects that we need offer no excuse for again discussing a subject which looks a little threadbare. It is generally conceded that the art of boiler making has made substantial progress during the last twenty years. The material made for boiler construction has undergone all the improvements that chemical analysis and highly developed methods of testing could suggest. These is little now left to chance, to good luck, or to skilful supervision on the part of steel makers. The art has reached the condition where steel of certain physical and chemical properties may be depended upon as the product of every furnace heat, so that "poor material" ought never to cause failure of firebox, staybolts, or flues. With all that as aids to boiler making, the writer was told last month by a veteran railroad manager, who is an engineer, that he had never experienced so much trouble and so many failures from leaky fireboxes and leaky flues as his road endured last winter. Similar complaints had been heard from other railroads geographically far apart, and the impression conveyed was that failures from leakage of locomotive fireboxes and tubes are increasing rather than diminishing. Assuming that this is true, the question naturally comes up, what is the cause of this increasing trouble?

The prevailing tendency for two or three years has been to lenthen the flues considerably more than what for many years had become established practice. Those who favored making tubes longer than usual reasoned that the increase would provide the means of absorbing more heat from the fire gases and consequently arrest part of the heat that was wasted through the very high temperature of the smoke box. So by lengthening the flues two or three feet, the smoke box temperature could be reduced 100 degrees or more, the saving would be considerable, and it would be effected without any extra attachments being put upon the boiler. Theoretically there seemed to be everything in favor of increasing the length of the flues and nothing against it.

We have not obtained any exact data to show the connection between lengthening the tubes and the increase of trouble from leakage, but the information which has come to this office leads us to believe that there is a close relationing between the two. There are two causes calculated to make a long boiler tube leak more readily than a short one. First, there is greater movement of the tube in the flue sheet, since the expansion and contraction are in proportion to the length of the tube acted upon by the heat; the second cause for long tubes breaking more readily than short ones is that the supports being so far apart the tubes set up movement in the middle which tends to shake the tubes loose in their fastenings.

Another source of weakness in a boiler with inordinately long tubes is the tremendous strains put upon the firebox sheets through the long distance between the back firebox sheets and the forward flue sheet. The great amount of expansion and contraction in a boiler 28 or 30 feet long have destructive effects that are not present in the short boilers, which seldom cause much trouble from leakage. A firebox 10 feet long secured to a boiler shell 20 feet long presents a form that is striving to tear itself apart from the first day that it is fired up, and it is only a matter of time for disintegration to make itself felt. This long body is accountable for the cracked firebox sheets that increase the cost of repairs, waste fuel and cause delays on the road, besides putting the engine out of service so frequently that imperative boiler caulking or patching may be done. Locomotives having the short, wide firebox are not nearly so destructive on side sheets as those with extremely long fireboxes and they do not cause so much annoyance from leaky tubes. It may be that the development of the locomotive as a power producer may entail the general use of wide fireboxes. The short, wide firebox provides sufficient grate area and heating surface while shortening the distance between the back of the firebox and the front flue sheet, thus reducing the strains due to expansion and contraction, even when long tubes are employed.

In discussing the trouble that falls upon railroad companies from leaky tubes and fireboxes, it must not be forgotten that the prevention of leakage or the causing of leakage is very frequently due to careless work at the fire-cleaning pit. A common practice is to clean or dump the fire with the blower going at full blast, drawing cold air like a hurricane into the hot firebox and tubes. Very frequently an engines comes in from the road with flues and firebox sheets perfectly tight and goes out with them leaking. A little more attention bestowed upon the men who clean the fires would often prevent leakage. There is seldom any attention given to preventing cold air from streaming over the heating surfaces when the fire is drawn. It would be a wise thing for our round-house foremen to adopt the plan, almost universally followed abroad, of having the dampers closed and a cover put upon the smoke-stack immediately

after the fire is drawn. If these people would study the little book on "Care of Boilers," by Henry Raps, we are persuaded it would be the means of saving thousands of dollars annually to the railroad companies they serve. But because these are little details, they are frequently neglected, while much attention is directed to other matters that are not nearly so important from a money saving or money wasting standpoint.

There is comparative little annoyance caused by leaky heating surfaces in regions where the feed water is free from mineral impurities. The scale formed by hard water puts a partly new conductor over the heating surfaces, which cause them to rise to a very high temperature when the engine is working. The high temperature induces a wide range of expansion and contraction and therefore causes leakage of tubes and staybolts and cracking of side sheets. The true remedy for that is softening the feed water; but when that plan is not adopted much good can be done by proper and thorough washing of the boiler at frequent intervals.

Not a small share of the leakage common with the enormous boilers used on some roads is that firing has to be kept up so constantly that the firebox door has to be open nearly all the time. The only remedy for that, as far as we can see, is the adoption of mechanical stokers. When that useful invention comes into general use, as it is destined to do some day, it will do much to prevent leaky boilers and will put an end to other evils connected with hand firing.

The Coming of the Steam Turbine.

The steam engine has undergone no radical changes since Watt in Great Britain and Evans in America developed the crude atmospheric engine of Newcomens into a motor that was adapted to all purposes where energy taken from the combustion of fuel could be employed more cheaply than any other form of power. Watt and Evans both followed the Newcomen principle of using a piston in a cylinder to produce reciprocating motion. To make such an engine adapted for driving machinery, it was necessary to convert the reciprocatory to rotary motion, which was done by means of a crank or its equivalent. The steam engine had been applied to manufacturing purposes only a short time, when engineers began to realize that great inconveniences and disturbing forces accompanied the use of heavy reciprocating parts, and the question naturally arose, why cannot we have an engine that will produce rotary motion direct? In the early engines no counterbalance weights were used to counteract the irregular motion due to heavy cranks tending to accelerate motion during one part of the stroke and retard it on another part, so that with the pioneer steam engine it was difficult to maintain uniform rotary motion. Mechanicians soon proceeded to work out inventions intended to minimise the distributing forces by counterbalance weights and other devices; but the best of them left a good deal to be desired, and the demand for direct rotary motion kept asserting itself.

One of the first inventors to attempt the production of a rotary engine was James Watt. Watt was one of the most ingenious inventors the world has ever seen, yet his rotary engine was one of the most imperfect motors ever put into patent specifications; but he was the first inventor in that field, and his successors naturally profited by his mistakes. The description of a proposed rotary engine was made in connection with claims for improvements on steam engines and read: "Where motions round an axis are required, I make the steam vessels in form of hollow rings or circular channels with proper inlets and outlets for steam mounted on horizontal axles like the wheels of a water mill. Within are placed a number of valves that suffer any body to go round the channels in one direction only. In these steam vessels are placed weights, so fitted to them as to fill up part or portions of their channels, and yet capable of moving freely in them by means hereinafter mentioned or specified. When the steam is admitted in these engines between these weights and the valves, it acts equal on both, and so as to raise the weight on one side of the wheel, and by the reaction of the valves successively, to give a circular motion to the wheel, the valves opening in the direction in which the weights are pressed, but not on the contrary."

That specification is interesting to those who study steam engineering matters, owing to the fact that it was the first attempt in modern times to produce direct circular motion by steam, and it was the first of thousands of patents obtained, to perform the same operation. No line of invention attracted more master minds than the rotary engine, and no line recorded more hopeless failures. A great variety of mechanism has been tried to transmit the steam pressure in rotary engines, the most promising type having had a rectangular piston rotating upon a shaft passing through the axis of a cylinder. The fatal objection to that arrangement was the difficulty in securing steam-tight packing. When the packing was made nearly tight, the friction of the rubbing parts became so great that a large proportion of the work done was wasted in friction, making the engine decidedly less efficient than a reciprocating engine. The principal advantage claimed for a rotary engine was their simplicity; but many of them had devices for preventing leakage of steam that made them more complicated than any other form of engine in use. Professor Thurston mentions rotary engines under five classes: (1) a system of gearing without valves; (2) a system in which the steam chamber revolves, the work being done by reaction; (3) a jet of issuing steam impinges upon the vanes of a revolving wheel; (4) an arrangement in which a rotary motion is effected by a wheel having fixed vanes, or some equivalent, by introducing sliding abutments and valves, between which and the vanes of the wheel, steam could be introduced and expanded; (5) revolving wheels or disks set eccentrically with the cylindrical casing, in such a way that sliding vanes passing into and out of the wheel may intercept the steam and compel it to turn the disk. It was supposed that the two latter types of rotary engines would use the steam so economically that they would do work with less steam than a reciprocating engine, but they never did so.

Apart from providing an effectual remedy for the shocks due to the unbalanced weights of a reciprocating engine, the rotary was calculated to produce a horse power from much less dead weight, and it ought to have saved much of the loss in reciprocating engines, due to cylinder condensation. When inventive genius failed to make a successful rotary engine, some one went back to the most ancient forms of steam engines, and on its principal developed the steam turbine which is coming rapidly into use, and bids fair to take the place of the reciprocating engine for all purposes where steady revolving motion is required.

All students of steam engine problems are aware that Hero, a philosopher who lived in Alexandria more than a century before the Christian era, published a description with drawings, of a reaction steam wheel, which was worked for various purposes. There is good reason for believing that various forms of this engine survived what is known as the Dark Ages, and in 1629, a radical improvement on it was effected by Branca, an Italian philosopher, under whose hands it emerged as an impact steam turbine. Why the pioneer inventors of the reciprocating engine did not take up the steam turbine idea is one of the curiosities of invention.

When the designing of a practical rotary engine seemed to be a hopeless task, inventors began to work on the improvement of the steam turbine, which is really a rotary engine, and very substantial success has been achieved. At the Columbian Exposition at Chicago, a steam turbine was exhibited from Sweden which attracted extraordinary attention, and many people believed it was going to push the reciprocating engine out of the field in a few years; but tests conducted by practical engineers demonstrated that it used too much steam per horse power developed to be a dangerous rival of first-class engines. About that time Par-

sons of England was working on the improvement of the steam turbine, and the application which he made of it to torpedo boats and other sea-going vessels, made his invention famous and is pushing it into popularity. The Westinghouse Machine Company of Pittsburg, are now building what is known as the Westinghouse-Parsons engine, which uses steam about as economically as the best forms of reciprocating engines, and has already been applied to several electric generating plants. The demand for this form of engine is much greater than the means of supply at present, and it is a great favorite in the places where it has been installed.

In a recent issue of RAILWAY AND LOCOMOTIVE ENGINEERING, we published a description of a small steam turbine which is used for driving the dynamo of the Edwards headlight, for which it is admirably adapted, and does its work with economy of steam rarely reached with small reciprocating engines. It is not practicable to use the steam expansively with a simple steam turbine, to the same extent as can be done with a reciprocating engine of the same power, but there are savings of steam in other ways that make up for the limited expansion. It is well known that the ordinary forms of steam engines waste an enormous amount of steam through cylinder condensation, owing to the alternate cooling and heating of the metal composing the cylinders. This is seldom less than 30 per cent. of the steam drawn from the boiler, and frequently reaches 50 per cent. In the steam turbine there is no such loss, for there is practically no fluctuation in the temperature of cylinder metal, and the saving effected by this peculiarity is very material. The steam turbine has certainly come to stay, and its prospects for becoming a favorite prime motor appear to be highly encouraging.

High Train Speeds Safe.

The British board of trade returns show that while a speed of sixty to seventy miles an hour is maintained daily by many trains, mishaps are rare, compared to those of twenty years ago. It is, moreover, proved that with the steady increase of speed and more numerous trains, the safety of the average passenger has become far greater. Another popular misconception was also corrected. It is generally believed that the high speed of express trains unnerves the drivers of the locomotives and brings on various maladies, besides rendering them unfit for the strain of the work after a comparatively short term of service. This view is not supported by facts. One of the best locomotive drivers in England has been at the throttle over fifty years, and can be trusted any day with the fastest train in the country. Sir Henry Oakley, the general manager of the Great Northern railway, on which probably a higher average rate of speed is maintained than on any other English railway, says that of sixty men who were driving express trains regularly in 1886 forty-three are still at their posts. Of the rest only five have died, all from acute diseases—hernia, pneumonia, etc., one being killed by an accident, the others having retired. It is doubtful whether better prospects are enjoyed by sixty men of the same age engaged in any other responsible occupation. It is further stated that no confirmation can be obtained of the view that habitual travelers suffer from vibration caused by high speed, and this immunity is attributed to the comfortable fittings of even third-class cars on most railroads in England.

This is something for that class of our railroad managers to ponder over, who scheme to dispense with the services of old train men as soon as they begin to have gray hairs. As long as his eyesight remains good the services of an old engineer are more valuable than those of a young one.

American Standard Specifications for Steel.

BY PROFESSOR ALBERT LADD COLBY.

The days of taking the word of a steel maker or seller for the physical and chemical properties of material to be used for industrial purposes are past and all purchasers require that the material shall conform to certain specifications. That the character of specifications should be uniform is of great importance both to seller and buyer. Those who will be benefited by uniformity in specifications of steel will be under obligations to Professor Colby for his book on American Standard Specifications of Steel, the second edition of which is before us. The author is a member of Committee No. 1 of American Section of the International Association for Testing Materials and took a very active part in working for the adoption of American Standards by the International Association.

In the introduction to the book Professor Colby briefly outlines the history of the work of establishing American standard specifications of steel from which we learn that the Association of American Steel Manufacturers took the lead in the work in 1895 and that the efforts of this organization resulted in the formation of the American Section of the International Association for Testing Material. This association was the means of bringing together steel makers, steel consumers, engineers, professors in technical schools, delegates from scientific societies and others interested in having standard specifications adopted. A large and representative committee was appointed, whose members appointed a subcommittee, which collected and tabulated the requirements of existing American specifications which were used as a basis in forming ten proposed American standards, which with some modifications, were afterwards adopted. These specifications were submitted to the Congress of the International Association for Testing Material held at Buda Pesth last year, and they will be submitted for international adoption to the same congress which will meet at St. Petersburg in 1903.

The publication of the text of these specifications in Professor Colby's book will be a great convenience in letting the world know exactly what the American standard specifications for steel are. Space does not permit us to enter into detailed particulars. It is sufficient to say that they are very comprehensive and seem to cover the entire field. They are treated under seven headings, viz.: Process of manufacture; chemical properties; physical properties; test pieces and methods of testing; finish and variation of weight; branding; inspection.

We presume that this work will at once become a text book of steel specifications. It ought to be in the hands of every engineer in charge of constructive material and of every chemist connected with departments of tests. It is sold by the author at South Bethlehem, Pa. Price, $1.10.

Books.

Examination Questions for Promotion. By W. O. Thompson. RAILWAY AND LOCOMOTIVE ENGINEERING. New York.

Another of the little books which help pass examinations and keep at the head of the engineers' list. The writer has been intimately connected with locomotives for years, much of the time as traveling engineer, and evidently knows just the points an engineer and fireman is interested in.

It is impossible to give even an idea as to the variety of questions, but it can be safely said to cover a great majority of the subjects examiners touch upon. It comes in two bindings, one at 50 and the other at 75 cents.

When a passenger is about to start in a train in Europe there is a practice of holding a seat by putting a bag, wrap or other piece of baggage in the place to be occupied, and habit has led most people to respect the claim established. The courts have decided that the baggage method of pre-empting a seat has no legal status, and the Western Railway of France, which is one of the most progressive railways in Europe, has adopted a novel and sensible way of holding a seat. Over each place in a compartment is placed a disk, and as each is occupied a number is placed on the disk and a duplicate is handed to the passenger by the conductor, which keeps him entitled to the place should he leave it temporarily.

A Milholland Locomotive That is Still in Service.

When we look back at the locomotives turned out by James Milholland and the good work they have done we begin to appreciate his efforts toward the advancement and development of the locomotive.

While most of these locomotives have gone the way of all things human or mechanical, there are still a few in actual service. The locomotive shown is No. 139 of the Philadelphia & Reading road and is one of the old "swallow tails" built in about 1874, and so-called from the firebox sloping back from 46 inches at the front end of cab to 32 inches at fire door. This was done to reduce the weight overhanging the back drivers and it gave a very roomy cab.

The main dimensions were:

Cylinders—17 x 22 inches.

Drivers—67½ inches.

Steam Pressure—120 pounds.

Weight on Drivers—33,264 pounds.

Weight, Total—57,000 pounds.

Boiler Diameter—40 inches.

Boiler Length—21 feet 4 inches.

Flues—170—1¾ inches—11 feet 5 inches long.

Firebox—34 x 84 inches.

This engine is now running regularly between Allentown and Philadelphia, a total of 136 miles for the round trip, makes all stops and hauls 3 to 4 cars the same as the other engines on this run, burning about 4 tons of coal for the round trip. Considering the size of the engine and steam pressure, this is remarkably good work and it refutes the claim (in this place at least) often made, that the apparent good records made by old engines are due to lighter cars in those days. These are the standard cars in regular service.

The engineer, Mr. Lewis Rowland, of Allentown, Pa., is standing by the engine.

Paderewski's Turntable.

Paderewski, the Polish pianist, he of the nimble fingers and unpruned mop of hair, recently set guessing the yardmen of the Rock Island road at Davenport. His private seventy-foot Pullman arrived from Chicago with the pianist aboard. After the Davenport concert the car was ordered back to Chicago on the first fast passenger train. Then the trouble began. Paderewski, who could not sleep riding backwards (or with his feet toward the engine) any more than he could play a piece of music backwards, insisted that his car be turned. Investigation developed that there was no turn-table in the vicinity of sufficient length to accommodate the 70-foot private Pullman. It had almost been determined to run the car to Colona, Ill., and around the Y formed there with the Burlington tracks, when one of the yard men suggested that the car be turned on the draw of the government bridge that crosses the Mississippi river at that point. The draw turns both ways and is one of the longest swinging spans in America. Accordingly, the car was centered over it, swung around a half circle and quickly turned. Paderewski smiled at the achievement and murmured: "Besser, besser. Yankee ingenuity—vat you call him? Oh, yes! Bully! Good!"

Finishing Piston Rods.

There is no doubt whatever that much of the trouble with leaky packing is due more to the rods than to the packing itself. This makes the finishing of these rods a live problem for progessive railroad men and brings up the question as to the best and cheapest way of finishing piston and valve rods.

Those who have studied the subject of producing surfaces which are *round*, or as nearly so as can be had in practice, know that it is necessary to finish by grinding. But this has always been considered as an expensive refinement, and we have, in many cases, put up with seven-sided piston rods left as they come from the lathe or improved (?) by filing.

The Norton Grinding Company, whose grinder we illustrated in the issue of June, 1901, has succeeded in proving that the cheapest way is to grind in a heavy machine built especially for the work, and should have no difficulty in securing converts to their way of making rods, now that they have disposed of the haunting specter of increased cost.

Their plan of procedure is to take a roughing cut in a heavy lathe with a feed of from 6 to 8 per inch, and then put the rod directly on the grinder for finishing. This requires less time than turning to size in the lathe, and, of course, produces an infinitely better job.

As an example of the work this machine is doing, they have favored us with a sketch of a lathe spindle, 50 inches long, having nine different diameters, from 4 to 6½ inches, which was finished by one of their customers in one hour and forty-five minutes. When we consider that the spindle was of 60-point carbon steel, that four one-hundredths of an inch was removed by grinding, and that the limit of error was half a thousandth of an inch, we get an idea of the capacity of these machines.

ONE OF THE MILHOLLAND "SWALLOW-TAILS."

Russian Examination of Travelers' Baggage.

A dispatch from St. Petersburg gives the interesting information that the examination of passengers baggage at the frontiers will be much stricter in the future than it has been in the past. The writer has twice had his baggage examined at Russian frontier stations, and he could imagine of nothing more thorough than the examinations that were made. All the pieces of baggage were arranged on a platform which extended along the four sides of an oblong room. The examining officers were inside the quadrangle thus formed, and the passengers outside. Every package had to be opened and most of the contents were pulled out, and in many cases thrown upon the floor. Garments were shaken out of the folds and closely searched for articles that might be concealed in the pockets. We saw one officer make a great fuss with a man who had a camera and insist on its being opened for minute inspection. If the Russian government are going to make inspection of travelers' baggage more strict they can only do so by insisting that the garments be torn apart.

The Dressel Railway Lamp Works are putting out a long-burning oil fount for switch and semaphore lamps. They hold oil enough for seven days and nights with one filling, and the wick needs no attention in the meantime.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Slid-Flat Wheels in Winter Time.

As before remarked in these columns, the winter time gives railroads much more trouble from slid-flat wheels than any other season of the year. In confirmation of this, a Canadian correspondent writes saying that the aforementioned trouble in his territory is exceedingly aggravated in winter time. Two or three major causes of the trouble will therefore bear discussion. It is quite apparent to the ordinary observer that the rail in the winter season is generally much more slippery, due to the presence of frost, snow and ice, than during other seasons of the year when slippery track from moisture, grease and mud must be contended with. In both cases the adhesion between the rail and wheel is decreased, and the friction between the wheel remains the same as on a good, adhesive rail. The result is wheel sliding. A thoroughly wetted rail offers as good adhesion as a perfectly dry one, the sprinkled rail and greasy rail being the ones to expect sliding from during the summer season.

Another prolific source of slid-flat wheels in cold climates is that of the hose couplings pulling slightly apart, just enough to break the joint and allow the rubber gaskets to overlap, and thus permit the train-pipe pressure to escape past the gaskets to the atmosphere. When the train is standing still, the hose couplings are air tight; but when it is running and is stretched, the stiff, frozen hose, being unable to stretch, will pull slightly apart and leak away train pipe pressure. If the pump is unable to supply these leaks, the brakes will set, causing wheels to skid and flatten. This is especially true where a poor quality of hose is used and the hose becomes rigidly frozen, thereby causing it to more resemble a tin or sheet iron tube than a flexible hose coupling. Perhaps an investigation of the absorbent qualities of some of the hose now in use would lead us quite a distance away from the slid-flat wheel trouble.

There is still another important cause, hitherto not considered, which, if duly traced and carefully analyzed, might give us considerable additional and new information as to the causes of slid flat wheels. We mean the condition of the journal in its brass in the journal box. Frequently the lubrication of the journal in its bearing is either insufficient or imperfect, and results in an undue friction there, which tends to retard the forward motion of the wheel when running. Such a car will be hard to pull, and a train of such cars will very readily be detected by the engineer and be styled a "hard-pulling train." On the other hand, a "hard-pulling train" should be an easy train to stop. It is well-known by engineers who pick up out of side tracks cars which have been standing for a number of hours during the winter season, that they will pull exceedingly hard. This is easily traceable to the fact that the lubrication of the journal in the box is either frozen or lacking, thereby producing a frictional resistance which makes that car hard to pull. It is reasonable, therefore, to expect that a poorly lubricated journal will offer as much resistance to the rolling action of the wheel while the train is being stopped, as it will while the train is being accelerated or put in motion. Therefore, the excessive journal friction acts as additional brake force to retard the rotation of the wheel, and finally causes the wheel to slide. Possibly a further search in this direction might reveal some interesting information and important factors in wheel sliding in very cold weather, when in warm weather no trouble is experienced.

In wheel sliding troubles, it is only too frequently the case that the leverage is reduced to a point where wheels will not slide on a bad rail. This is unquestionably a grave error. If an engine should slip on a bad rail, it would be considered folly to reduce the steam pressure until the engine would not have strength to slip, as it would have very little power to haul its train. Likewise with the air brake, if the brake power should be so reduced as to prevent wheel sliding on bad rails, the brake would be weak and could not be relied upon to supply sufficient braking power to do ordinary stopping when the brakes were used on good rails.

It would seem, therefore, that a course open to the better operation of air brakes in very cold climates to prevent the sliding of wheels would lie in a better and more efficient lubrication of car journals, and in the use of hose that would not become abnormally stiff in cold weather. Even the best of rubber hose will stiffen up in cold weather; but a low grade of hose is much more liable to absorb atmospheric moisture and moisture from the melting snow and from rain than would a hose well coated with a good quality of first class rubber.

A "Perpetual" brake shoe—a shoe of such hard material that it never wears out, and consequently offers the least possible retarding or holding power—is like an indigestible dinner which does not nourish and is a troublesome trespasser as long as it remains.

Incompetent Driver Brakes.

The cause for a large number of slid flat wheels on cars is the underbraking of the locomotive and tender. Generally a great deal of attention is given to the foundation brake gear and the condition of air brakes on cars, but the same is not so often true of the locomotive. In too many cases, the pull-up type of driver brake is used, which allows considerable leakage at the stuffing box, decreasing the power of that brake. Again, the location of the driver brake cylinder on the fire box side causes the leather packing to dry out and not be air tight, thus allowing the brake to slip off almost as quickly as it is applied. Perhaps one of the greater causes for the driver brake not holding is the fact that brake shoes employed are of a kind which last almost indefinitely and afford very little holding power. In these cases, the train is obliged to do the work of holding itself, and undue additional work of holding back on the locomotive and tender, compelling the greater work and double duty done by the cars to pick up their wheels and slide them.

It is very seldom that we hear of locomotive driving wheels being slid flat. If such flat spots make their appearance, it is generally because the locomotive has been reversed when the air brakes were applied and the engine running, and not by the driving wheels doing too great brake duty.

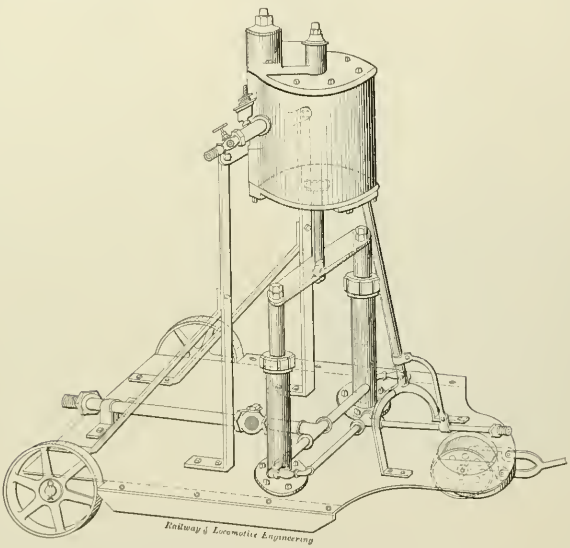
Looks Like It Had Been Cleaned.

There is a new trick in air brakes. The cleaner of brake cylinders is the inventor this time. He is one of the old "chalk cleaners," and the new rules of the Master Car Builders and the Air Brake Association have forced him to abandon the "chalking" of uncleaned cylinders and get one step nearer the real thing. It was getting too hot for him and he was forced to invent a new trick. Here it is. He removes the cylinder head and other parts, but does not pull out the piston. He wipes the cylinder out as best he can under these conditions and puts in a dose of grease. Then he replaces the head and other parts, puts the date on the cylinder and demands the twenty cents allowed by the code. He does not inspect or clean the leather packing, which may be worn through in a dozen places, for all he knows. Neither does he know the condition of the leakage groove, the follower plate and studs, the expander, or the pressure end of the cylinder. He should be watched for and given the same punishment as the old-time "chalk cleaner."

Frozen Train Pipes.

The committee appointed by the Air-Brake Association to report on "frozen train pipes, the cause and cure," will submit a report at the April meeting that will be second to none ever presented to the association.

The work of the committee has been unusually good and painstaking. An exhaustive series of tests has been made during the winter, with intelligent direction and with necessary instruments to secure unmistakable and full data on the subject. Persons interested in this important subject (and there are thousands who are) can look forward to the committee's report for some very important and interesting information.



EIGHT INCH AIR PUMP MODIFICATION USED BY THE "BIG FOUR" FOR GIVING BOILERS A HIGH PRESSURE WATER TEST.

A Deserved Appointment.

Mr. Wilber P. Garabrant has been regularly appointed General Air Brake Inspector of the United Railroads of New Jersey division of the Pennsylvania Railroad. This includes all of the Pennsylvania lines east of Philadelphia. His office will be at Jersey City, and he will report to and receive instructions from the Superintendent of Motive Power direct. Mr. Garabrant has already demonstrated his fitness for the position, and hard and conscientious work has placed him there. His immediate officials are to be congratulated as well as he.

Brake cylinders should never be so located on locomotives or cars that the heads cannot be removed for cleaning purposes.

CORRESPONDENCE.

Air Brakes As Affected By Extreme Cold Weather.

In the February issue I notice an article by Mr. B. Baker, touching on the subject, "Canadian Winters and Skidded Wheels," which should interest every man handling air brakes in extreme northern or cold climates. Perhaps the most likely way to bring this subject to the notice it deserves would be to come out with the flat assertion and say that the air brake with the present average attention is not what it should be on long freight trains, but is far from it, when the thermometer registers below 25 or 30 degrees below zero. Up here it often dwells around 50 to 60 degrees below.

In reference to skidded wheels my experience differs somewhat with Mr. Baker's, in the absence of any official statement of flat wheels entered in my record. The difficulty here is to get sufficient braking power to make a slow, safe stop, as one application is all that can be depended on, as a rule, and sometimes not that under these conditions. As a rule one application is sufficient to make a reliable stop, let alone skidded wheels, as the air cannot be kept in the cylinders long enough to even heat the brake shoes.

My belief is that skidded wheels will be most generally found when a large percentage of empties are hauled one way. I believe the reason for this is light reductions and leaky train line. I find a good way to overcome the difficulty is to make at least 10 to 13 pound reduction before releasing, even when a 5-pound reduction will bring the train to a stop. Of course, the extra heavy reduction will not be necessary during very cold weather, as immediately the valve is placed on tap, the train line hose couplings will attend to any further reduction required, after which comes a tug of war between air pump and Jack Frost.

I suppose the rubber hose coupling was adopted to provide a flexible union between the cars, and, in mild weather, it is admirably adapted to same. But where does the flexibility come in when two men, with a club under the coupling, and a third man with his hands failed to bend the hose sufficient to uncouple, and on train parting, the hose will frequently break clean off rather than straighten out and uncouple, on account of being frozen so solid? Undoubtedly the effect on packing leathers and triple valve pistons must be somewhat similar. Of course instructors will say, and not believe otherwise, that in exceptional cases, by making an emergency application, the packing leathers will expand and stay expanded until again thawed out; but experience proves the contrary.

Would it not be possible for some inventive genius to make a suitable metallic piston ring, similar to a steam piston, and a flexible metallic coupling between cars that would be unaffected by extreme cold, instead of the present cold weather rubber failure?

If any individual instances of brake failures are required in support of above contention, they may be had by the quantity around this district between the dates of Dec. 1 and April 1, any year, with train in the hands of good average air brake handlers.

Perhaps a little discussion on this subject would bring out some good points, and incidentally completely demoralize the writer.

J. WHITEHURST,
Locomotive Engineer.

Fort William, Can.

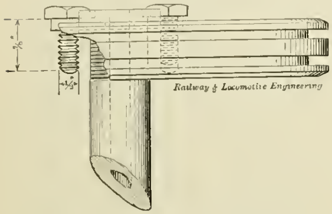
The successful instructor is not always the man who has command of a voluminous vocabulary and a fine flow of language, but is more often the plain talking man who is able to make himself clearly understood. It would be better, in selecting a man for an instructor, to choose the poorer talker, if he be logical and intellectual; for he will convey the idea more quickly, and his results will be more lasting than those of the man who talks fluently and voluminously.

An exceedingly unfortunate feature of the Ninth Annual Convention of the Air Brake Association is the threatened limited attendance, due to the restrictions of the free pass exchange agreement.

Reversing Plate Bolts.

Having had considerable experience in air-pump maintenance, I cannot fully endorse the type of reversing plate bolt shown on page 490, and do not agree when it is claimed that that bolt will reduce engine failures; for I am of the opinion that it will increase rather than diminish pump failures, and will here state my reasons.

Most certainly the ⅜ inch bolt now used is too small in diameter, and is a fruitful cause of pump failures, for it is



REVERSING PLATE BOLTS.

badly strained in setting up and often broken in attempting its removal.

I have found it necessary to remove the plate on a hot engine to extract a broken reversing valve stem, to replace the plate by a new one, unexpected wear having developed in the old plate; also to inspect the end of the piston-rod. By all means use the ½-inch bolt. To rivet over the end, however, is a bad idea, according to my experience.

What I would advise is, a plate designed and shown on page 490, same bolt head, same diameter (½-inch), and same thread, but of the same length as the ⅜-inch bolt, substantially as shown in attached sketch. FRANK RATTEK.

Manchester, N. H.

Triple Valve Testing Appliance.

The accompanying sketch is a device used as a triple valve connection when testing valves in the shop on the tester, and is designed with a quick coupling in view, which is done by the upward movement of the lever.

The thumb, or adjusting screw B, is used to adjust the yoke C, all check valve cases not being exactly the same distance as shown. D is a gasket dovetailed, so as to be held in place when the apparatus is not applied to the valve. The lever is raised and just passes the center line, and is held in that position by the lock pin E.

This device is being used at the Illinois Central shops at Burnside, and is found to be quite a time saver, for it expedites the repair of triple valves.

W. W. UPDEGRAFF.

Chicago, Ill.

Ninth annual convention of the Air Brake Association, Pittsburg, Pa., April 29, 1902.

Westinghouse vs. Vacuum Brakes.

In your March issue I see Mr. Norman D. Macdonald takes exception to the remarks I made in a former letter as to the opinions held by drivers in this country regarding the merits of the Westinghouse and vacuum brakes. I am extremely sorry that I trod on the toes of such an old champion of the Westinghouse as I understand Mr. Macdonald to be; but still the truth must be told, and although he has never chanced to meet them, I can assure him there are a good number of drivers even in Scotland who prefer the vacuum to the Westinghouse air brake.

Speaking from the position of a practical engine driver who has handled both brakes, personally I prefer the Westinghouse, but this does not prove that every driver holds the same opinion. It is now part of my duty to ride upon engines and look after other men working the brakes, so that I think Mr. Macdonald will grant I am in a very good position to hear the opinions of drivers.

As regards his concluding remarks that the vacuum fitted trains have to be started constantly with brakes more or less on, I can only say that in my experience it has not happened so frequently as to warrant me using it as an argument against this brake. Neither do I think it does happen very often if the driver is operating it properly. WILLIAM LEITH.

Aberdeen, Scotland.

Work of an Air Straining Device.

I noticed an editorial in the Air Brake Department of LOCOMOTIVE ENGINEERING presumably referring to the hair strainer recently put upon the market. Referring to the same, I wish to give my experience with the device. The editor is undoubtedly correct in saying that the claims are somewhat exaggerated; but I have been much interested in the strainer since I saw the dirt emptied out of one of them that had been on but a few trips. Furthermore, I wish to say that I have used or seen used, hair strainers for a number of years, and I find that the virtue of the strainer is not in the hair alone, but in the oil or other adhesive substances it is saturated with, simply showing it is the little things that make a success or failure.

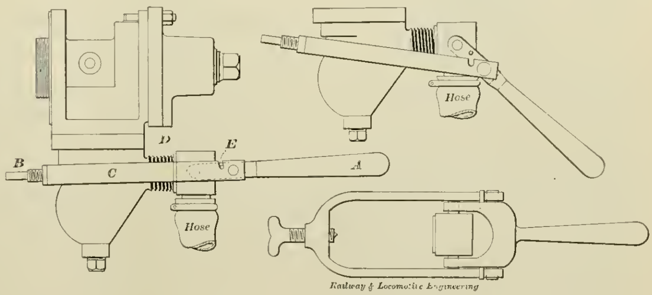
For illustration we applied one of these strainers to a new passenger engine pulling from 7 to 10 cars, with 9½-inch pump on. After 12 months' service, making a total of 96,000 miles, this engine was shopped. Upon examination of the air cylinder of the pump, I found the tool marks as plain as when the pump came from the factory. Tool marks were also visible on the packing rings. The air end was in perfect condition and was replaced on engine without a cent of cost.

Another engine in the shops at the same time, having had a new 9½-inch pump without a strainer, having made about 20,000 miles, was found in such condition that it was necessary to bore cylinder, renew packing rings, piston, valves, etc., costing several dollars, which would indicate the strainer was a very good thing. Furthermore it seems to me that it is of equal importance to the rest of the equipment, thus preventing a considerable amount of dirt from getting into the brake valve, governor, tripple valve, etc.

CHAS. F. GREGORY,
General Foreman Shops, C. St. P. M. & O. Ry.

Sioux City, Iowa.

[Undoubtedly this is a very good record, and reflects much credit on the device which can achieve such results. However, the number of miles run and the cars hauled is a useless and erroneous basis to use in making comparisons of air pump work. The better and correct basis would be the amount of air pumped, the stops made, etc., which would more truly and accurately represent the actual air pump work done.—ED.]



TRIPLE VALVE TESTING APPLIANCE.

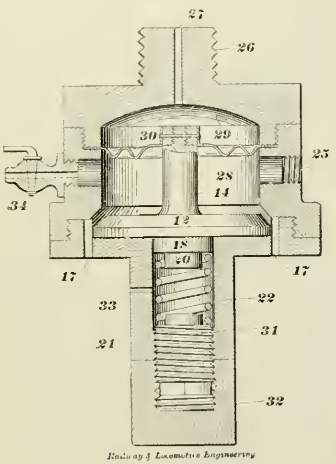
The value and popularity of the Examination Questions and Answers is attested by the sale of over fifteen thousand during the past year.

Pressure Retaining and Recharging Device.

I herewith hand you blue-print of a pressure retaining and recharging device of mine which you may publish if it is of enough interest.

Referring to blue-prints 26 is valve body. 27 is port for auxiliary pressure to pass through. 30 is diaphragm. 31 is an adjusting screw. 32 is a cap nut. 33 is a relief port. 34 is a cock to be kept open when it is not desired to use the valve. 12 is a valve seat. 14 is a valve body. 17 is final exhaust openings. 18 is valve body end. 21 is a coil adjusting spring. 25 is an opening to which triple valve exhaust is tapped.

Operation is as follows: The threaded end of the device is screwed into auxiliary at any convenient place. To retain full brake-cylinder pressure, coil spring is set at, say 68 lbs. Now, when



PRESSURE RETAINING AND RECHARGING DEVICE.

auxiliaries are charged to 70 lbs. valve 12 stands open. When brakes are applied, valve 12 will go to seat and remain so until auxiliary pressure overcomes tensions of spring 21. After brakes are applied and it is desired to recharge or release, put brake-valve in release position, and air will discharge from the brake cylinder, through triple valve exhaust, into opening 25 and against valve seat 12. As diaphragm 30 and valve seat 12 are exactly the same size, there is no disturbing effect caused by air thus far. As soon as auxiliary pressure overcomes tension spring 21, valve 12 will be unseated, and air from brake cylinder is free to pass to atmosphere through final exhaust openings 17 in valve cap.

Yours truly,

M. McCemas.

R. H. Foreman, M. K. & T. Ry.

Greenville, Texas.

Brake Cylinder Location.

I have recently observed some engines which have the driver brake cylinders in a bad position, as shown by sketch 1.

The prettiest and most sensible position that I have ever seen for the driver brake cylinder, placed forward, is illus-

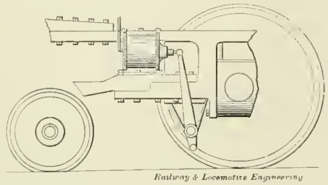


FIG. 1—BRAKE CYLINDER LOCATION.

trated by sketch 2, taken from a lot of new ten wheelers for the Bangor & Aroostook.

Manchester, N. H. FRANK RATTEK.

Improved Air Valve.

I enclose sketch of a new button air valve, at least, the supposition is that it is original.

This valve is designed to be attached to a rubber hose used to blow off brass chips, dust, etc., off lathes, work benches, etc.

With an ordinary cock or valve it requires two hands to operate. With this valve, which ust fits the hand, all that is necessary is to push the button and the air does the rest.

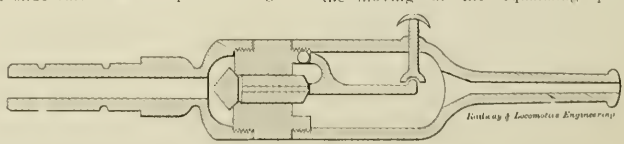
The valve is very simple and easy to make, and has been found very satisfactory in the way of saving time.

St. Paul, Minn. A. MUNCH.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(152) C. A. B., Staples, Minn., writes: What duty does the graduating spring perform with a light service application with a very short train; also with a long train? A.—With a service reduction on a very short train, the graduating spring of the triple valve resists the full travel of the triple piston, and holds the parts in position so the graduating feature may operate without any further movement of the slide valve. As the piston and grad-



AN IMPROVED AIR NOZZLE VALVE.

uating valve are the only parts that move in succeeding graduations, the friction of the moving parts is exceedingly small, the graduations are finer and there is a minimum of wear on the slide valve and its seat. On a long train, the above described graduating feature is performed without the aid of the graduating spring. In fact, on a long train, the triple will graduate just as well without a graduating spring as with it.

(153) C. A. B., Staples, Minn., writes: A New York brake releases after being set. How can it be told whether the cause is in the cylinder, auxiliary reservoir or triple? A.—The release may be due to an increase of pressure in the train pipe, decrease in auxiliary reservoir or leakage of brake cylinder pressure. The person present must analyze the existing conditions and determine which of causes produced the trouble. Then he must search further and determine what irregular detail produces the cause. See the Air Brake Association's examination questions and answers. Look at the part which describes the disorders and defects of the New York brake; also those of the Westinghouse.

(154) A. A. C., Rawlins, Wyo., writes: I would like to have you answer this

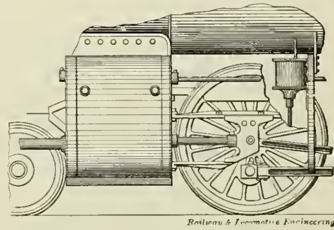


FIG. 2—BRAKE CYLINDER LOCATION.

question, as I think it is a hummer. It is on a New York brake valve, Vaughn-McKee style. In making a service application, the brake valve will equalize all right if moved one service notch to another, right after each reduction has been made. But if the valve is left standing in any of the service notches 2 or 3 minutes or more, no more of a reduction can be made in any of the service notches. Furthermore, there was no train pipe leakage, as the gage did not show it. This is the only brake valve I ever saw do this. A.—There is only one thing primarily that can do this, and that is the moving of the equalizing piston toward train pipe pressure and away from the supplementary reservoir pressure. Since there is no train pipe leakage, there must necessarily be an increase of supplementary reservoir pressure. This increase could only come from the main

reservoir pressure surrounding the main slide valve, and probably leaked under the valve into the supplementary reservoir when the valve handle was left for a considerable time in the service notch.

(155) W. C. H., Fitchburg Mass., writes:

The slide valve feed valve sticks me. Please tell me a good book on air that will explain it clearly. A.—This is nicely described and explained in the examination questions and answers, formulated by the Air Brake Association at their last convention, and for sale by us for 25 cents, postpaid.

(156) C. A. B., Staples, Minn., writes:

Have you any treatise on the air brake? I desire very much to take up this line of work. A.—We have them all. See our book department which appears in each issue.

(157) T. F. H., New York city, writes:

In your answer to Air Brake question 147, in April paper, you say, "Possibly the leakage groove is stopped up," as a reason for brake not releasing after bleeding auxiliary. I do not understand what the leakage groove has to do with the releasing of a brake. Please explain. A.—When train line pressure has been reduced to zero, setting the brake full, the triple is at its extreme working stroke, thus connecting direct the auxiliary, reservoir and brake cylinder and giving equal pressures therein. Upon opening the bleeder on the auxiliary, air from both cylinder and auxiliary will be drawn out. When the auxiliary pressure has been reduced slightly lower than the tension of the compressed graduating spring, the triple piston will move from full stroke to lap position, thus cutting off communication between the brake cylinder and auxiliary reservoir. By this time the brake cylinder pressure has been so reduced that the release spring in the cylinder has forced the piston almost home. If the leakage groove is clear, it will allow the remaining brake cylinder air to leak out and the brake will be entirely off. However, if the groove is not clear, and the slide valve seat is well oiled, the slide valve will resist the tendency of the brake cylinder air to force it off its seat and to escape into the auxiliary reservoir and out through the bleeder to the atmosphere. Hence the brake will stay set.

(158) J. S., Milan, Mo., writes:

Can two 8-inch air pumps be compounded? If so, please give us the method. A.—Yes. Connect both pumps up to the same steam pipe. Connect the air discharge pipe of pump No 1 into No. 1 reservoir. Then connect the suction of pump No. 2 into No. 1 reservoir, and the discharge pipe of No 2 pump into No. 2 reservoir. With this arrangement you can pump an air pressure twice as great as your steam pressure Electricians would say these pumps were connected in "series."

(159) J. S., Milan, Mo., writes:

Will two wheels attached to the same axle, of different diameters, run to the low side on straight track? A.—There would necessarily be a slipping back of the larger wheel or a slipping forward of the smaller one to keep them side by side, even though they were held in place on the car by the journal box. With relation to the track, however, the tendency would be for the wheels to seek the low side.

(160) D. S., Chicago, Ill., writes:

In regard to the automatic slack adjuster question 570 of the examination questions and answers, I would like a fuller explanation to question 570. As far as I can understand the workings of the adjuster, if the brakes are applied, it can't take up only after each application of the brakes. Please explain. A.—Slack can be taken up only after an application of the brake, and only then if the piston travel is greater than that amount predetermined. See questions 568 and 569, which explain the operation of the adjustor. Question 570 asks whether it would not be better to take up the slack in "big bunches" as it might exist if someone had let out slack on the dead levers or replaced a broken connecting rod with one much longer. The answers say that it is better to take up in small quantities and have narrow limits rather than take up in "bunches" and have wide limits.

(161) P. J. F., Oelwein, Iowa, writes:

1. What is the proper angle-cock to open first when coupling engine to nonchanged cars? A.—1. All those in the picked up cars, except the rear cock, then the one on the forward end at the first car. 2. With cars attached to engine and picking up cars already charged, and why? A.—2. The forward cock on the section being picked up, because the pressure in those cars would probably be lower, and only one emergency application would be caused by the coupling up operation. 3. With ten cars attached to engine picking up cars not charged? A.—3. The same as in the preceding case. 4. How should the engineer handle the brake valve in each case? A.—4. He had better lap it during the coupling up operation in all cases to save his main reservoir air, as he doesn't know whether the rear cock is open or there is a possible broken train pipe on the picked up cars.

(162) M. H. L., Brooklyn, writes:

Why does the air whistle blow just one long blast when the cord is pulled two or three times? A.—The pulls are probably made too close together. They should be at about one second duration, and one second between pulls.

European Railway Jottings.

BY CHARLES ROUS MARTENS.

The close of the year 1901 has witnessed the advent at last, after long anticipations, of a new type of compound engine on the Midland Railway. They are of three-cylinder design, but as they really belong to the year 1902, and as the first of them is as yet merely in the experimental stage, while information available is somewhat meager, it will, I think, be better that I should let them stand over to a future date, as also a new variant of the "2606" Midland type with large Belpaire boilers, which has also just emerged from the Derby shops. During the past year Mr. S. W. Johnson has continued to build his standard 7-foot coupled class. The later number of these, however, have 19-inch cylinders instead of 19½-inch. Their boiler heating surface is only 1,193 square feet, whereas Mr. Johnson's original boilers of twenty-five years ago, had 1,225 square feet; but here again the nominal loss in heating surface area is believed to be more than compensated by the superior disposition of the tubes and by the greatly increased size of the firebox, which is no less than 8 feet in length. I have some records of very good work with these engines.

The principal new departure of 1901 on the North Eastern Railway, as regards express locomotives, has been dealt with pretty fully in my earlier letters. I refer of course to the gigantic six-wheeled coupled express engines of the so-called "Ten-wheeler" type with 80-inch drivers and cylinders 20 x 26 inches, with a weight, in working order, of 67 tons, exclusive of tender. Five of these have been constructed by Mr. W. Worsdell, and all, by their admirable performance, have abundantly justified their novel design.

Toward the close of the year just expired, Mr. J. G. Robinson, the new chief mechanical engineer of the Great Central Railway, brought out a fresh class of four-coupled engines for the express service of that line. They have 81-inch coupled wheels, leading four-wheeled bogies, cylinders 18½ x 26 inches, 1,378 square feet of heating surface and 180 pounds steam pressure. They weigh 53 tons in working order. In some experimental trips with these engines I obtained extremely favorable results, and I understand that more are to be constructed. On the Lancashire & Yorkshire, Mr. H. A. Hoy has converted one of his predecessor's penultimate standard class, with 87-inch coupled wheels, into a four-cylinder compound somewhat resembling the London & North Western "Jubilee" type. At present sufficient information about this experiment and its results is not available to enable me to deal with the matter now. I may have more to say about it later.

Apart from this single instance there have been no new departures on either the Lancashire & Yorkshire, the North Brit-

ish, the Glasgow & South Western or Caledonian, with reference to express engines. On the Highland Railway Mr. P. Drummond's new ten-wheeler class, with 5-foot 9-inch six-coupled driving wheels, has come into regular service and appears to be doing very well. Like Mr. Aspinall's "1400" class on the Lancashire & Yorkshire, it possesses over 2,000 square feet of heating surface, these two classes being the only passenger engine types in the country to have so large an area.

I have already referred incidentally to the strikingly novel departures made by several British railways in respect of engines intended for freight or mineral service. Several of these have been constructed respectively by the Lancashire & Yorkshire, Great Northern, London & North Western, North Eastern and the Caledonian lines. All have eight-coupled driving wheels, either 51 or 54 inches in diameter, but in no case is the American method adopted of providing a leading pony truck. They therefore do not belong to the "Consolidation" class. The Great Northern, Lancashire & Yorkshire and Caledonian eight-coupled engines have inside cylinders; the North Eastern has its cylinders outside; the London & North Western, being a four-cylinder compound, has two high-pressure cylinders outside and two low-pressure inside. All appear to be giving marked satisfaction, but it is early days yet for me to offer any matured results. Mr. J. F. McIntosh's Caledonian engines of this class I described at some length in a former letter.

Of six-coupled goods engines the most notable are those recently built by Mr. Robinson for the Great Central line. These are noteworthy for the great size of their boilers, which are no less than 5 feet in diameter. A batch of very efficient six-coupled goods engines, which, however, possess no special features of novelty, has been supplied to the South Eastern & Chatham line by Mr. Wainwright.

The new British tank engines of the year have not been in any special way noteworthy.

Crossing the English Channel into France, one does not find very much of striking novelty. The splendid "Atlantic" type of express engines on the de Glehn four-cylinder compound system are being largely multiplied by M. du Bousquet for the French Northern Railway. Eighteen more are in the course of construction. Unlike the two pioneers of the type, the next eighteen will have six-wheeled tenders instead of eight-wheeled, as the adoption of the track tank and tender-scoop for picking up water at speed enables a much smaller tender tank to be used than hitherto. On the same railway M. du Bousquet has lately brought out a very fine twelve-wheeled tank engine for suburban service. It has four wheels coupled and leading and trailing four-wheeled bogies. The American engines supplied to the State and Paris, Lyons & Mediterranean Railways of France are now getting into regular work, and seem to be giving satisfaction. Most of the French railways built or procured so large a number of new express engines in preparation for the expected Exhibition traffic of 1900 that they seem generally now to be "lying on their oars" for a time, being apparently equipped up to the extent of their existing requirements. The Southern Railway of France is, however, having a few engines built on the de Glehn four-cylinder principle, but of the "Consolidation" type, having eight wheels coupled and a leading pony truck. These have recently been put to work on the severe grades of the Pyrennean sections of that line, which are at the rate of 3 to 3.2 per cent for considerable distances. The de Glehn compounds are still being largely multiplied on the French and Swiss and some German railways, and continue to give results so exceedingly satisfactory that I imagine their introduction into this country, and perhaps also into America, is only a question of time.

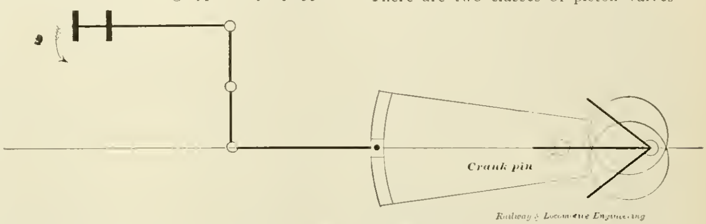
Enginemen Getting Hit by Obstructions Near the Track.

Several cases have happened within the last few months of engineers being killed or injured in the cab by coming in contact with bridges, water cranes, mail bag catchers. That accidents of this character are becoming more numerous is no doubt due to the greater width of cab put upon recent engines, but the convenience of the men in the cab ought not to be increased at the expense of their safety. The greater part of the accidents have happened on engines where the cab is on top of the boiler and engineer and fireman separated. This has given a strong argument for those who are agitating to have a third man put on engines of this character, and the politicians are inclined to make the best of it. It goes without saying that no permanent structure should project near enough the track to hit an engineman who is looking out of the cab. The men responsible for this kind of accident will be fortunate if they escape indictment for manslaughter.

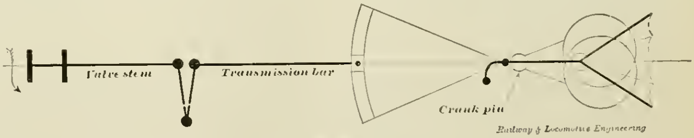
Setting Piston Valves.

The setting of piston valves is, for some people, more or less surrounded by an atmosphere of mystery. There is, of course, no mystery about it, and at close range even the possible haze in the atmosphere, disappears.

There are two classes of piston valves in use; those which admit steam to the cylinders from their outer edges or ends, and those which admit steam from the central portion, or from the inside of the body of the valve. The former may, for want of a better name, be called "outside" admission valves, and the latter "inside" admission valves. The outside valves are similar to the ordinary "D" slide valve, and other things being equal, they are set just as the "D" valve is set. These outside valves have the advantage, possessed by all piston valves, of enabling locomotive designers to make short steam passages, and to pretty evenly balance the valve itself. The inside admission piston valve is not exactly like the "D" slide valve, but it possesses the additional advantage over other piston valves, that it is more perfectly balanced, because the valve rod works only in exhaust steam and the valve chamber covers are only required to sustain intermittent exhaust steam pressure. The valve stem packing has also an easier time of it, and lastly the central admission feature, has the effect of holding hot live steam where temperature losses are less likely to occur.



OUTSIDE ADMISSION—INDIRECT.



OUTSIDE ADMISSION—DIRECT.

The setting of these outside and inside admission piston valves is modified by the method of connecting them with the links and eccentric rods. There are two ways in which this connection may be made. The first, and most familiar in locomotive practice is with an ordinary rocker, pivoted in the center with one arm up and the other down. This rocker transforms a forward thrust of an eccentric rod into a backward valve movement, and is called indirect connection. The other method, that of direct connection is where valve

stem and transmission bar (which latter terminates in the link block), are each attached to rockers, the arms of which are both above the pivot point. With direct connection a forward eccentric-rod movement produces a like forward motion of the valve.

We have, therefore, before us, two types of valves, and two methods of connection. The old adage that "two and two make four," holds good on railways, as it does elsewhere, and we have four possible combinations to deal with. Designating them by the names already used, we may have an outside-admission, direct-connected valve, or to put it concisely an "outside-direct" valve. Then follows the inside-direct; the outside-indirect, and the inside-indirect valves.

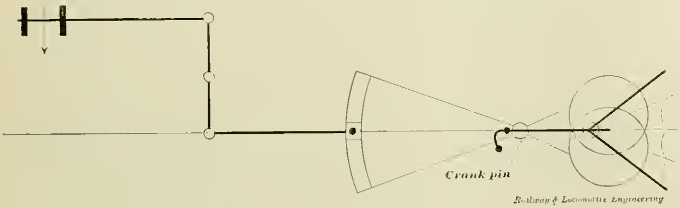
In setting any one of these piston valves it is necessary, first of all, to ascertain to which of the four classes, the valve in question, belongs. Knowing this, we further find that the position of the eccentrics, when the valve is of the outside-direct type, is that the belly of each lies on the side of the vertical center line, farthest from the crank-pin, or to put it another way, if the crank pin be represented by the figure IX, on the dial of a clock, and the center lines of the eccentrics, by the hands, the latter will stand approximately at 5 minutes past 5; all three lines roughly resembling an umbrella blown inside out. The outside-admission valve, we have said, resembles closely the familiar "D" slide valve, but its direct connection, in this case, forces the eccentrics to conform to stationary practice. With the inside-direct valve, the eccentrics lie on the same side as the crank-pin, and their lines make. what we may call, an arrow-head, with the crank-pin on the arrow shaft. The outside-indirect, eccentrics also assume the arrow-head position, while the inside-indirect, eccentrics are set with lines suggesting an umbrella blown inside out.

If one may summarize what has been said, it will be seen that the inside-direct, and the outside-indirect, valves, have eccentrics placed on the arrow-head plan. If any one cares for a possible aid to memory on this subject, he may say to himself that to reach the *inside, direct,* is exactly what an arrow might be expected to do; and further by a curious association of opposite ideas. the other condition, viz.: *outside, indirect,* also affects the arrow-head plan. The other two valves, the outside-direct, and the inside-indirect, follow the only method left, and place their eccentrics in the unfortunate umbrella position.

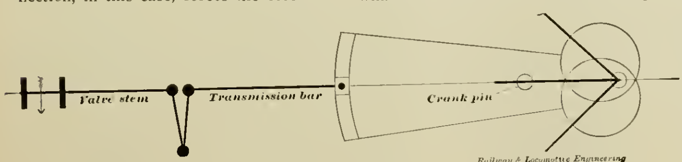
On the Central Railroad of New Jersey they have the two classes of valves, set on arrow-head principle, but they have only one "umbrella" on that line, not intended to keep off rain, as it is of the inside-indirect type.

In setting the Vauclain-compound piston valves the C. of N. J. people measure the valve very carefully, and they place it so as to give the forward center-punch mark on the valve stem. This is done by examination, with the front valve chamber cover, off. They then double the lap of the valve, and lay off that distance on the valve stem, from the front center-punch mark, and that point becomes the back center-punch mark. The valves are then set like ordinary slide valves, with this point always in the mind of the man doing the work, that if he is setting valves which require what we have called the umbrella plan, the valves must be moved *away from* the crank-pin, to increase the lead, and *toward* the crank-pin with the arrow-head kind.

There has been an improvement made on a number of this company's engines, which have valve-stems extending through the front cover. They do away with gland and packing at the front end, and enclose the stem in a piece of closely fitting wrought iron pipe, and plug the end. First cost, maintenance, charge, and general round-house trouble, is thereby materially reduced.



INSIDE ADMISSION—INDIRECT.



INSIDE ADMISSION—DIRECT.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters in the waste basket.

(129) W. M. A. says:

Brooks engine 655 is a Columbia type except she is a six-driver engine, what is the name of the type? A.—This is a Prairie type engine or a 2-6-2 type according to the Whyte system.

(130) W. H. B. asks:

Will you please inform me if the smoke-arch of British and German locomotives contain a netting for arresting cinders. Also the length of arch. A.—British and German locomotives have no netting in the smoke-box. The length of the smoke-box varies from 30 inches to three feet.

(131) F. W. R., Winona, Ill., asks:

For a definition of a "heavy" and also of a "light" steam gage? A.—If you have a boiler which is carrying 100 pounds pressure as shown on a correct, standard test steam gage, and that at the same time the gage you are doubtful about, shows 105 pounds, then the gage in question is heavy by 5 pounds. If on the other hand, this gauge in question registers only 95 pounds, it is said to be 5 pounds light.

(132) J. W. L. asks:

1. What size hole is usually put into a hollow staybolt? A.—The Falls Hollow Staybolt Company. whose bolts are rolled hollow their entire length, inform us that one-eighth to three-sixteenth holes are usually specified by the railway and marine trade. 2. Does the air going through the hollow bolts aid or hinder combustion? A.—It should assist combustion. 3. Is it better to have a hole clear through a staybolt or just drilled in at end? A.—Opinions differ. It would seem as though the rolled hollow bolt would be less apt to break, having no point at which the drill stops. Then, too, the rolled holes are practically central while some drilled holes are far from it.

(133) J. A. asks:

What is the best method of blocking a piston valve, broken within the chamber or with valve-stem broken within the valve chamber? A.—The best way is to take off both valve chamber covers, centre the valve, put a block of wood of proper size in each end to hold it central, and put on the covers. You then take no chances. If you are in a desperate hurry and know positively whether the valve is an outside

or inside admission, direct or indirect connected valve, push it to the front end and secure the stem. This fills the cylinder with steam. Move the engine so that this steam will hold the piston against the cylinder cover at one end or the other; disconnect and block. If you are not absolutely sure of what you are doing, adopt the first mentioned plan.

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(134) T. F. L., Sayre, Pa., asks:

Is the method of testing heavy 4-cylinder for blows through pistons and valves applicable to high-speed compounds as well as heavy ones? A.—Yes if the high-speed 4-cylinder compound is like the heavy ones in cylinder and valve arrangement. (2) Is the method applicable to compounds having low-pressure cylinder on top? A.—Not exactly, as the cylinder cocks are in the high pressure cylinders. Tests not involving manipulation of cylinder cocks are applicable. With low-pressure cylinders on top, if they are provided with indicator plugs, slackening off one or both they might be made to do duty as cylinder cocks for the purposes of the test. (3) Does Auchincloss deal with a rocker arm motion in his work on valve motion? A.—He does. He deals with both direct and indirect valve motion.

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(135) O. J. B., Hopkins, Minn., asks:

What is the raising of water in a boiler? A.—Foaming is probably what you are thinking of. When steam is formed in clear, pure water, each little bubble as it rises is instantly freed when it gets to the surface, and passes up into the steam space comparatively dry. Foaming generally takes place in greasy or soapy water. Each steam bubble as it tries to break away from the surface, is enveloped in a film like a soap bubble which is carried up a certain distance before it breaks. When this goes on to any extent a large amount of frothy water is carried up into the throttle with harmful results. Another danger in foaming, is the difficulty of telling the true level of the water in the boiler. The remedy is to shut down as soon as possible and wash out the boiler. (2) What is wire drawn steam? A.—Steam is said to be wire drawn when it is so throttled that its pressure is seriously reduced after it has left the boiler, or if fed into a cylinder through so small an opening as not to be able to follow up the piston with anything like the proper effective pressure. (3) Is there any, and if so, about how much, difference between a mechanical and a flesh and blood horse power? A.—The H. P. was first used by Watt. It is the raising of 33,000 pounds one foot high in one minute of time, or 550 foot-pounds per second. A good horse might be able to do this for a short time but he could not keep it up. An average, given by some authorities, is to place the flesh and blood H. P. at about ¾ of the mechanical H. P.

(136) J. H. W., Georgia, asks:

For rule to find tractive power of an engine of any given cylinder stroke, steam pressure and weight. A.—The usual formula is

$$T = \frac{d^2 \times s \times p}{D}$$

Where T is the tractive force, d is the diameter of the cylinder in inches; s is the stroke in inches; p the average pressure in the cylinder, taken at about 85 per cent. of boiler pressure; D the diameter of the driving wheel in inches. (2) Also to find weight on drivers and weight on truck separately. A.—It is almost impossible to do this without special apparatus. The best way is to run the engine pilot first on a set of track scales, stopping just before the leading driver comes on the scale table. Weigh the engine truck. Move the engine over the table until the truck is off, and weigh. Then run the engine ahead, fully off the scales, and reverse the operation by backing on, weighing drivers first, backing further until only the truck remains, and weighing. The average of these weights will give an approximate figure only. The reason this method is not accurate is on account of the internal friction of the machine itself. When standing with truck on the scales, and drivers on the solid track, the truck sinks down slightly, but the driving journals, not being knife edges, offer a frictional resistance, together with that of the spring rigging, boxes in jaws, etc., etc., and prevent a positively accurate result from being obtained. (3) Also the rule to find weight necessary to counter-balance an engine. A.—(1) Weigh the reciprocating parts, piston and rod, crosshead and pin, and small-end half of main rod. Add these together and call the total A. The weighing of the rod is done by placing it upon knife edges through crank and wrist pin holes, one of which supports rests upon a set of platform scales. Reverse the rod when weighing the big-end half. The sum of these two weights should be the weight of the rod. (2) Weigh the revolving parts, that is, the side rods as distributed to each wheel, and to the weight of the side rod on the main wheel, add the weight of the big-end half of the connecting rod, weighed as described above. The distributed weight of the side rod on each wheel is ascertained in the same manner as the connecting rod. All the parts of the side rod should be coupled together, placed on knife edges, passed through crank-pin holes, the rod carefully leveled, and the weighing machine inserted under each knife edge in turn. The sum of these weighings should equal the total weight of the rod. (3) Then ⅔ of weight A, previously found, should be divided into as many parts as there are driving wheels, on one side, and added to the weight of side rod, found for each wheel, together with the big-end of connecting rod on the main driver. We have now ascertained the weight to be balanced at the radius of the crank pin. (4) Place each pair of driving wheels successively upon a pair of trestles with journals resting on smooth flat strips of iron or steel, and carefully leveled. Hang weights to one of the crank pins until it comes down to a horizontal position, and if pushed gently in either direction will return to its position. If then the hanging weight for each wheel is equal to the weight found, in each case by the scales, the wheel is correctly balanced. If not the balance weight in the wheel should be adjusted by increasing or decreasing according as it is too low or too high. Each wheel should be separately adjusted. (5) Example for a consolidation engine. Reciprocating weights (supposed):

Piston and rod	525	pounds.
Crosshead and pin	232	"
Little-end half of connecting rod	239	"
	996	"

$996 = A$

$996 \times ⅔ = 664$ lbs.

$664 \div 4 = 166$ lbs. per wheel

Revolving weights.	lbs.	¼(A×⅔)	Totals
Side rod, *LL*	97	+ 166	= 263
Side rod, *LI*	231	+ 166	= 3[illegible]
Side rod, *LD* — big-end half *C* rod	284 + 485 = 769	+ 166	= 935
Side rod, *LT*	99	+ 166	= 265

TABLE FOR BOTH SIDES (SUPPOSED).

Wheel	Wt. Found.	Shortage.	Wheel.	Wt Found.	Shortage.
	lbs.	lbs.			
LL	218	45	*RL*	197¼	65¾
LI	181¼	215¾	*RI*	146¾	250¼
LD	497¼	437¾	*RD*	568¼	366¾
LT	207¾	57¼	*RT*	198¼	66¾

Total *LH* = 756¼ Total *RH* = 749½

The Industrial Water Company, whose methods and apparatus are being quite largely used by railways troubled with bad water, have moved their office to 126 Liberty street, New York. Their latest catalogue shows the apparatus which forms a continuous automatic water softening plant, delivering any desired quantity of softened and purified water per hour.

Of Personal Interest.

Mr. J. H. McGill has been appointed master mechanic at Somerset, Ky., vice Mr. D. Brown resigned.

E. J. Pearson is appointed assistant general superintendent, Northern Pacific R. R., office at St. Paul, Minn.

Mr. J. E. Goodman has been appointed mechanical inspector of the Northern Pacific Railway, with headquarters at St. Paul.

H. M. Curry will have charge of Fargo shops of the Northern Pacific Railway, and mechanical matters of the Dakota Division.

Mr. Samuel Parslow has been appointed foreman in charge of all brass work of the St. Paul shops of the Great Northern R. R.

W. S. Clarkson now has charge of Livingston shops of the Northern Pacific Railway, and mechanical matters of Montana Division.

Mr. John Dickson, general air brake instructor of the Great Northern Railway Line, has been appointed superintendent of shops at Everett, Wash.

J. H. Sally has been assigned to the entire Montana Division of the Northern Pacific Railway, and headquarters will continue to be at Livingston.

H. H. Warner is now in charge of South Tacoma shops of the Northern Pacific and Tacoma terminals except locomotive service in Tacoma yards.

Morris Hickey is now master mechanic, Northern Pacific Railway, with headquarters at Seattle, in charge of mechanical matters of Seattle Division.

Mr. R. D. Smith has been appointed superintendent of motive power of the Burlington & Missouri River Railroad in Nebraska, with headquarters at Lincoln.

Mr. F. H. Manss has been appointed passenger agent of the New York Central & Hudson River R. R. Co., at Albany, to succeed Mr. F. E. Barbour, promoted.

S. L. Bean will hereafter have charge of Brainerd shops of the Northern Pacific Railway, and mechanical matters of first and second districts of Lake Superior Division.

Mr. C. S. McManus has been appointed superintendent of the Charlotte Division of the Southern Railway Company, with office at Charlotte, N. C., vice Mr. W. B. Ryder, resigned.

Mr. Wm. Donahue has been appointed traveling engineer of the Western Division of the Chicago, St. Paul, Minneapolis & Omaha, succeeding Charles Cartwright, deceased.

Mr. George R. Parker, air brake instructor Iowa Central Railway, has been appointed general air brake instructor of the Great Northern Railway Line, succeeding Mr. Dickson.

Richard Smith has been made master mechanic, Northern Pacific Railway, with headquarters at Glendive, Mont., and will have charge of mechanical matters of the Yellowstone Division, including Mandan terminal.

Mr. C. F. Richardson has been appointed road foreman of engines for the Baltimore & Ohio R. R. Co., with headquarters at Garrett, Ind. Mr. George E. Wilson is his assistant.

Mr. C. S. Larrison has been appointed air brake inspector on the Northern Pacific R. R. Co., with headquarters at St. Paul, succeeding J. E. Goodman, assigned to other duties.

C. E. Allen is now in charge of the entire Yellowstone Division of the Northern Pacific, with headquarters at Glendive, and will receive instructions from Master Mechanic Smith.

Mr. F. E. Barbour has been appointed general agent of the passenger department, with headquarters at No. 2263 St. Catherine street, Montreal, P. Q., to succeed Mr. H. D. Carter, promoted.

Mr. A. L. Moler has resigned as master mechanic and superintendent of the Macon, Dublin & Savannah R. R. at Macon, Ga., to accept a position as master mechanic on the Queen & Crescent at Monroe, La.

Mr. I. F. Wallace formerly with the Chicago, St. Paul, Minneapolis & Omaha R. R., has been appointed road foreman of engines on the St. Louis, Iron Mountain & Southern in charge of the Central and Valley Divisions.

Mr. Daniel Willard has been elected third vice-president of the Erie R. R. Co., with offices in New York as before. Those who have known Mr. Willard in previous positions will not be surprised to note his advancement.

Mr. H. C. Shields has resigned his position as assistant general foreman at the C. R. R. of N. J. shops at Phillipsburg, N. J., and accepted a position as division foreman of the B. & P. Division of the D. L. & W. R. R. at Bangor, Pa.

C. T. Hessmer is assigned to Dakota Division of the Northern Pacific Railway, in place of C. S. Larrison, assigned to other duties. Mr. Hessmer will have headquarters at Fargo, and will receive instructions from Master Mechanic Curry.

Mr. J. D. Hurley, formerly vice-president and general manager of the Standard Pneumatic Tool Company, has been appointed manager of the Chicago Pneumatic Tool Company, with headquarters at Chicago.

H. A. Lyddon is now master mechanic, Northern Pacific Railway, with headquarters at Staples, Minn., and will have charge of mechanical matters of the Minnesota Division and branches, except Como shops and car work at Minneapolis and St. Paul terminals.

James Bruce is appointed master mechanic, Northern Pacific Railway, with headquarters at Head of Bay, Tacoma, and will have charge of mechanical matters of the Pacific Division, except South Tacoma shops and Tacoma terminals, but including locomotive service in Tacoma yards.

Newman Kline is appointed superintendent of Pacific Division, Northern Pacific R. R., Tacoma, Wash., and pending the appointment of superintendent, Mr. C. W. Houston, train master, will assume charge of the Yellowstone Division, performing all duties and authority of division superintendent.

Mr. Edward N. Hurley, formerly president of the Standard Pneumatic Tool Co., and now a director in the Chicago Pneumatic Tool Co., sailed for London on April 17, to meet Mr. J. W. Duntley and complete arrangements for the sale of the International Pneumatic Tool Co. of London to the Chicago Pneumatic Tool Co.

Col. Jno. T. Dickinson, who has heretofore represented the Consolidated Railway, Electric Lighting & Equipment Company in Chicago, has been transferred to New York as general agent, with headquarters at the general offices of the company, 100 Broadway, New York; and Mr. Geo. W. Carhart has succeeded Col. Dickinson as general agent of the company in Chicago and the West.

Mr. W. E. Symons has resigned as superintendent of motive power and equipment on the Plant System, where he has been for a number of years. The improvement in the motive power department under his direction has been much commented on by patrons of the road. He has accepted a position with the Baldwin Locomotive Works and will spend considerable time in Great Britain and Europe studying modern locomotive practice in those countries.

President Ingalls of the Big Four, who is a statesman and a lawyer, besides being one of the most far-sighted railroad men in the country, has expressed himself as being decidedly opposed to the prevailing tendency to consolidating railroad properties. He perceives that the logical result of the movement will be in a large combination under one man control and he is

sagacious enough to understand that the people of this great country will not stand that. Mr. Ingalls advises all concerned to pause in their career of railroad conquest if they do not want to have their property taken under Government control.

Archibald Angus McLeod, who was at one time a conspicuous figure in railway and financial circles, died in New York last month. Mr. McLeod was for many years associated with the late Austin Corbin and was advanced by that astute financier to be president of the Philadelphia & Reading Railroad system. While holding that position Mr. McLeod conceived the idea of combining all the anthracite carrying railroads into a "community of interest" arrangement for offensive and defensive purposes. It was a stupendous scheme and he succeeded in securing control of the Central Railroad of New Jersey and of the Lehigh Valley Railroad. When he tried to obtain control of the Delaware, Lackawanna & Western he ran against financial interests that resented the enterprise of this comparatively new comer in the financial field and their influence was sufficient to wreck Mr. McLeod's plans. That interrupted what was previously a career of conquest and ended Mr. McLeod's railroad career, but greatly extended "community of interest" schemes were subsequently carried out, although it was never admitted that Mr. McLeod was the originator of the idea.

In a recent issue of RAILWAY AND LOCOMOTIVE ENGINEERING, a personal note appeared to the effect that Mr. James Buchanan had been appointed General Superintendent of the Richmond Locomotive Works. We are informed by Mr. H. A. Gillis, General Superintendent of the Works, that the position that Buchanan was appointed to was General Inspector.

The Consolidated Railway Electric Lighting & Equipment Company are issuing a series of pamphlets which are extremely valuable to those having this apparatus in charge The illustrations are excellent and show every part of the mechanism so perfectly that there should be no difficulty in thoroughly understanding all its workings. Copies of these can be had on application to the company.

The Falls Hollow Staybolt Company are naturally pleased with the result of a test of their hollow staybolt recently made at McGill University of a piece of one-inch double refined charcoal staybolt iron with a three-sixteenth hole. In a length of 25⅜ inches, the equivalent elongation in 8 inches was over 31 per cent., while the reduction of area was nearly 46 per cent. The yield point was 32,000 pounds per square inch and the ultimate tensile strength 49,300 pounds per square inch.

The offices of the general superintendent, general freight and passenger agent, and engineer maintenance of way, of the Southern Indiana Railway Company, are now located at Terre Haute, Indiana.

How He Protected Strangers to the Language.

A young man recently appointed traveling passenger agent for the Milwaukee division of a certain big railway, who was starting out on a business trip, had taken a seat in the sleeping car and was explaining to a friend the duties and possibilities of his new position. "The secret of success in a business of this kind is to make your patrons appreciate what you do for them," said he. "It does not do to drop a man as soon as you have induced him to buy a ticket and then chase after new victims. Now, as an illustration, there are two foreigners forward in the smoking car who cannot speak English, and I am going with them to the station where they change cars and see that they get on the right train and have the accommodations they are entitled to. I have their tickets and told them to show my card to the conductor and refer him to me."

The conversation at this point was interrupted by the entrance of the conductor.

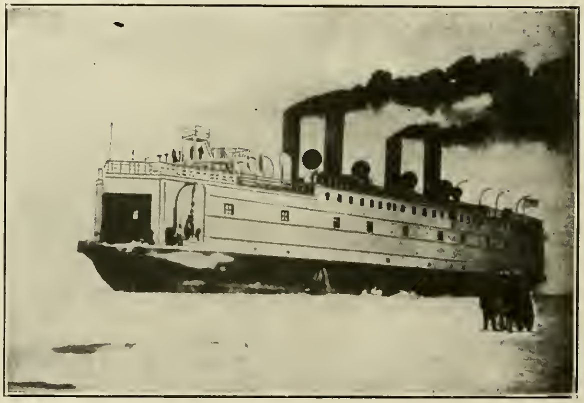
"By the way, conductor," he said, as he handed over his annual pass, together with the two tickets, "I suppose you found my two men up forward? Here are their tickets."

"Well, I don't know," said the conductor. "I stopped the train at a flag station seven miles back here and put off two fellows that couldn't talk United States, and when I asked for tickets showed me a card with somebody's name on it and said that was their ticket."—*Milwaukee Sentinel.*

Train Buried in Snow for Four Days.

It is a most extraordinary thing to read about a passenger train being buried in snow during the last week of March, yet that was what happened to a passenger train on the Great Northern. There were about 250 passengers on the train and they nearly perished from cold and hunger. There was some of the worst mismanagement in connection with this affair that we ever heard of. After the train was stalled in an arctic temperature, the engine, that possessed the only means of keeping the cars warm, was uncoupled from the train and sent back to try and reach a station where relief might be obtained. Of course the engine got stalled, as nearly always happens when an attempt is made to back an engine through heavy snow. Then the people in the train were left to freeze. The dining car conductor displayed good judgment by cutting down the supply of food to keep the people from starving by making it spread over several days. The whole train, after a time, became entirely buried in the snow and the danger of freezing to death was decreased. Three days after the train was stalled an electrician on the train found a telegraph instrument and connected it with the wires. By this means word was sent to the nearest division point telling about the plight of the train and a rotary snow plow was dispatched to their relief and reached the sufferers without much difficulty.

A very important question that arises in connection with this affair is, why was the rotary not sent out sooner with relief? It must have been certain enough that the train was stalled in the snow somewhere and it was a most extraordinary proceeding on the part of the superintendent or other responsible official of that division, to lounge about waiting to receive a message from the train.



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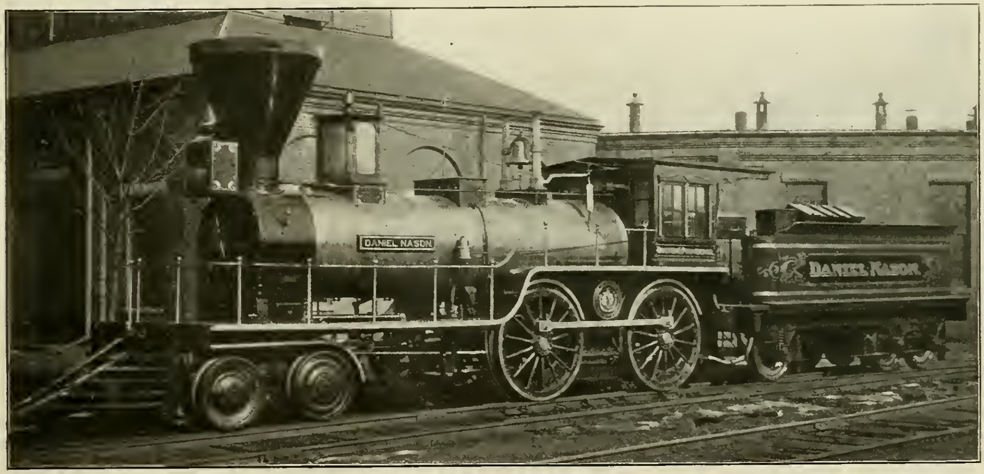
TRANS ASIATIC RAILROAD.—THE FORTY-MILE ICE-BREAKING TRAIN-FERRIAGE ACROSS THE LAKE BAIKAL.—(Armstrong, Engineers, Newcastle, England.)

A Bit of History About New England Locomotives.

The Daniel Nason was built in 1858, by George S. Griggs, M. M., of the Boston & Providence R. R. Drivers were four in number, 4 feet 6 inches diameter. Cylinders 16 by 20 inches. Total weight, 52,650 pounds. Tank capacity, 2,000 gallons. It is still on earth, but not in use.

Of the earlier engines on the Boston & Providence R. R. the first engine—the King Philip—had outside cylinders, eight wheels, weight 45,000, and was built by the Locks and Canals Co. of Lowell, Mass. The drivers were solid, no spokes.

The Old Boston was built in Liverpool, England. The firebox was covered with copper. She had English crank throttle; inside connected. Weight 27,000 pounds. On a plate on the dome is cast "B. & P. R. R., September, 1858. G. S. Griggs, Machinist."



AN ENGINE OF 1858—BUILT BY GEORGE S. GRIGGS.

One of the early coaches on the Boston & Providence R. R. There were six of them there at first. This one is reproduced from memory by the late John Lightner for the World's Fair in Chicago. This coach was in a smash up and for years was in the attic of the car shops at Roxbury, Mass. The B. & P. R. R. probably built larger cars to take the place of the original six. These cars were drawn from Dedham to Readville by horses at one time. They were designed in 1834.

A correspondent located at Albion, Pa., who does not want to have his name mentioned, writes a letter complaining about the long hours the trainmen are required to work on the Bessemer & Lake Erie. If our correspondent's wail is well founded, the Bessemer & Lake Erie Railroad Company ought to have a lot of extra men, especially engineers and firemen.

Improvements on Alton Shops at Bloomington, Ill.

Since Mr. S. M. Felton became president of the Chicago & Alton Railroad he has been carrying out great improvements upon the property. Great improvements have been effected upon the permanent way which will permit the traffic to be conducted at a material reduction of cost.

EQUIPMENT.

Since President Felton assumed the helm of the Alton, there have been purchased a total of sixty-seven modern passenger cars, built by the Pullman company, and the old equipment has been provided with air brakes, automatic couplers, wide vestibules, Pintsch gas, train signals and all modern improvements. There has also been added to the freight equipment 4,367 cars. The average tractive power of the locomotives has been increased from 15,000 pounds to 21,000 pounds, and the average weight of the locomotives has increased from 62,000 pounds to 88,000. The seating capacity of the passenger equipment has been increased from 4,686 to 7,525. The tonnage capacity of the freight equipment has been increased from 139,720 tons to 276,000 tons.

SHOPS.

Extensive work has been undertaken in connection with the remodeling of the shops in Bloomington. This provides for a thorough modernizing of the shops, tools and machinery. The most economical appliances are being provided, and the work, when completed, will involve an expenditure of $350,000. When the present Alton shops were rebuilt, after the fire which destroyed all the wooden buildings some thirty or thirty-five years ago, and when the new shops were finally completed in 1883, they were considered as fine a plant of railroad shops as could be found anywhere in the country. But the increased size of equipment rendered them totally unfit for handling it, and an almost entirely new equipment of machinery was necessary.

POWER-HOUSE.

In the old equipment of the Bloomington shops the buildings and tools contained in them were divided into two departments, the locomotive and the car department, respectively; each one of which was furnished with power from a large stationary engine, besides a number of auxiliary engines for each department. The steam for these engines was generated at four different boiler plants. Each one of these stations had its equipment of engineer, fireman and helpers. All of this is now being done away with and in its place a large centrally located power-house is erected, that furnishes by means of electric current the power needed in the various shops, as well as lights throughout the shops, shop yards and railroad yards.

This power plant consists of a brick building, 134 feet 10 inches long, by 74 feet 3 inches wide, and is divided in a longitudinal direction into two separate compartments of equal size and known respectively as the boiler-room and engine-room. The boiler-room contains four 350 horse-power water tube boilers, with the space provided for an additional 700 horse-power if required.

The engine-room contains three 300 horse-power cross-compound engines, direct connected to a 200-kilowatt generator, and one 150 horse-power tandem compound, direct connected to a 110-kilowatt generator, with space left for one 300 horse-power unit to be added at some future time; all of which are constructed for a 250-volt circuit and connected in parallel to a common switchboard from

which current is distributed to the various shops for both power and light as may be required. By arranging the switchboard connections or the machines to run in parallel any engine may be started and stopped at pleasure, according to the increase or decrease of the power required, without any interference whatsoever and without any particular manipulation of the instruments on the board except those instruments which control directly the current from any particular engine. The inconvenience that may result from a breakdown of any one of the units is therefore reduced to a minimum.

In addition to the main equipment in the power plant, a number of auxiliary machines are provided, as, for instance, large air compressors, hydraulic pumping plant, feed water heaters, etc., besides which the boiler-room contains a large water heating circulating plant of the Evans Almiral system, by means of which heat can be conveyed to all the shop and office buildings throughout the plant.

The coal is brought into the building by means of conveyors and stored in an overhead storage from which it is distributed into the stokers of the various boilers. The ashes for the boilers are taken by the same conveyor and put into an ash storage bin, from which it falls by gravity into a railroad car placed alongside the building when desired.

The stack for the boilers is constructed of steel and is 8 feet in diameter by 175 feet high and lined with fire brick to three-fourths of its height. The engine-room is lined to a height of 6 feet with white enameled brick, capped off with a line of dark brown enameled brick, making a very handsome appearance, and will facilitate the keeping of the walls in a cleaner condition than could be accomplished with common brick. The engine-room floor is laid with cement, whereas the boiler-room floor is laid with brick on edge in cement.

Every device known in modern engineering has been made use of in the construction of this power plant to make it in every respect equal to the most modern plant built, and from an economical standpoint nothing further could be wished for.

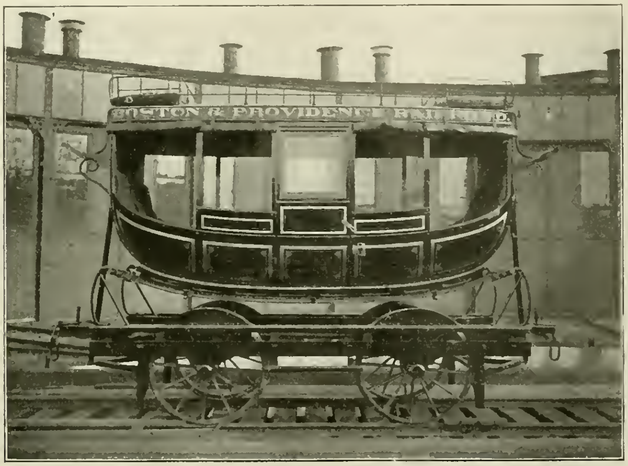
ERECTING AND MACHINE SHOP.

This building is 408 feet long by 114 feet wide and contains on one side eighteen tracks for the erection and repair of locomotives and on the other side the usual machine shop tools are located, the building being divided in the center by columns supporting the cranes. The old facilities in this shop consisted of overhead, rope-driven, traveling cranes of the Sprague manufacture, having a capacity of 22½ tons each. These cranes are taken down and replaced with electric cranes from the Case Manufacturing Company, each crane having a capacity of 50 tons. The old runways for the cranes are taken down and new runways suitable for the increased power substituted.

On the machine shop side there are two hand-power traveling cranes which will be replaced by fast running electric cranes. The machine tools formerly promiscuously distributed throughout the shops and driven with shafting and belt for the large stationary engine, have been rearranged in groups, according to the class of work, and driven by electric motors; besides which all large tools, such as wheel lathes, planers, etc., are driven by independent motors. The total number of motors to be installed in this shop, excluding crane motors, will be ten.

BOILER SHOP.

This building, which is of stone, 125x



THIS CAR RAN BETWEEN BOSTON AND DEDHAM MASS., IN THE YEAR 1834.

112 feet, is being entirely rearranged. The roof trusses have been raised to make room for a 25-ton electric traveling crane and a large riveting tower has been erected to contain a 25-ton riveting crane, having a 50-foot lift. A 17-foot gap hydraulic riveter will be placed in this shop. This riveter is of modern construction, and with the new crane facilities mentioned above the facilities for taking care of the most modern locomotive equipment cannot be excelled.

BLACKSMITH SHOP.

This building is of stone, 200 x 100 feet, and contains the usual equipment pertaining to the locomotive and car work of a railroad blacksmith shop. The old machinery in this building has become somewhat antiquated and is being replaced with modern steam hammers, furnaces, forges, bottle machines, bulldozers and all other auxiliary appliances which are required in an up-to-date blacksmith shop. The small machines will be grouped and run by belts from a common shafting, and the larger machines, such as punches, shears, etc., will have independent motors.

ROUNDHOUSE.

This building, which is of stone, may be said to be practically rebuilt. The outside wall has been taken down and moved 17 feet further out to make room for the large locomotives. The roof has been extended to the new wall, new modern smokestacks have been placed on the roof, pits have been extended, tracks and floor relaid and a heating system introduced, besides which there are pneumatic drop tables, boiler washing facilities, etc., to give all the attention to locomotives that may be required in the roundhouse and greatly reduce the detention of locomotives in the shops when requiring minor repairs.

All the other shops have been improved in like proportion, and the Bloomington repair shops are now among the best equipped establishments in the country. Mr. A. L. Humphreys, the new superintendent of motive power, will find a dream of perfection compared with the shops he was accustomed to in Colorado.

A Special Mechanical Induced Draft Fan.

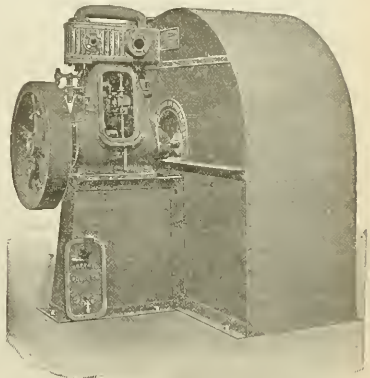
The direct-connected fan shown herewith is one of two similar pieces of apparatus which together forms a duplex induced draft plant installed in a large electric power plant of Northern England.

Each fan is capable of handling the gases from four Galloway boilers, each eight feet six inches in diameter and 28 feet long with a grate area of 48 square feet. The capacity of the fans are calculated on a basis of a coal consumption of 20 pounds per square foot of grate surface, using a Durham coal locally known as "Small Bean." The steam pressure carried is about 140 pounds per square inch. These boilers are arranged in conjunction with two economizers so that the gases are cooled to about 450 degrees Fahrenheit.

The fans in this instance are 100 inches in diameter and are driven at a speed of about 400 revolutions per minute, equivalent to a pressure of two inches of water at the fan outlet. All the gaseous products of combustion from the boilers after passing through the economizers, are drawn to the fans, which are situated on a platform above the boilers and discharged upward into the short steel stack.

Always Want Something Better.

The Joseph Dixon Crucible Company of Jersey City have received a number of very nice letters about the workings of the Homard lubricators for feeding their flake graphite into locomotive cylinders. One cites the case of an old scrap heap where the valves were in such bad shape that it was all a man could do to handle the reverse lever. Using about one and a quarter pounds of graphite in 1,500 miles smoothed it down so that it could be reversed with one hand.



BUFFALO INDUCED DRAFT FAN.

The problem of employing electric power instead of steam for railroads is receiving attention in Sweden. It is stated that the managers of the State Railways are investigating it, and a recent newspaper article announces that private concerns are also interested in the matter. A Gothenburg newspaper reports that the board of managers for the Falun-Vester-dalarnes Railroad Company has sent to the government a petition for the gradual adoption of electric locomotives, instead of steam engines, throughout the whole country, and the utilization of water power. The petition mentions that a machine firm in Switzerland has made a proposition to use the Huber system, by which an electric current can be generated when a train passes down inclines, which current can be utilized by other trains on the same road. The petitioners ask the government to furnish the money needed.

Items from the Editor's Note Book.

When Mr. Andrew Carnegie was making the address published in the March number of Railway and Locomotive Engineering, he got to joking at the expense of Mr. Robert Pitcairn, of the Pennsylvania Railroad, and said that Bob bossed the president. Then he said "by the way, gentlemen, that's a thing you must always do—never fail to boss your boss." I have noticed in the course of years' acquaintance, that there is always some true hit behind Mr. Carnegie's jokes. It seems a paradox to say "boss your boss," but there is a wonderful amount of that going on. According to my observation, there are a great many railroad officials from president downwards who would make very poor records if it was not for the ability of chief clerks, mechanical engineers and other highly competent help who do not appear in the play, but who practically carry on the business. One of the most incompetent men I ever was intimately acquainted with was manager of a big railroad. The only spark of ability he had was in the selection of competent help. His chief clerk managed the road and held his chief above ridicule. And there are others.

As a class, railroad officers are the ablest men I have ever had intercourse with, but some of them reach high positions by mysterious means not based on merit. On the other hand there are men of commanding ability who never succeed in climbing a single step up the ladder of official life.

A spectacle which I often watch with wonder is, a big Mogul engine working on surburban business and hauling four or five cars. That is a very common sight on railroads east and south of Chicago doing good suburban business. The only rational explanation I have heard of why an elephant is put on to do the work of a jackass is, that the big engine can accelerate the train more quickly than an engine suitable for the work. That expression "accelerate the train quickly" came in with the advocacy of electric motors, which their friends said were famous for accelerating the trains quickly. Steam railroad men are noted for following engineering fads and fashions. They are employing engines that will give all the quick acceleration wanted, but they waste a large amount of energy uselessly when they are not lifting trains into speed.

One of the pleasant items of news that come to me this month was notice of the appointment of my old friend, George A. Goodell, to be general superintendent of the Chicago Great Western Railway. I have worked in pleasant unison with a great many men in my time, but my recollections of the harmonious official relations that existed for years between myself and Mr. Goodell stand out like an oasis in the desert of railroad harassment. He was train dispatcher when I was engine dispatcher, and we both had exceedingly trying duties to perform, and it was highly important that we should cooperate for the expeditious movement of trains, and there never was the least friction. Mr. Goodell had the faculty of handling a multitude of details and at the same time took a comprehensive grasp of his business as a whole. Besides that he was exceedingly popular with the men under him, while being a strict disciplinarian. He advanced quite rapidly to telegraph superintendent, assistant and then division superintendent, but he stuck there for a long time, which was surprising, considering the number of small pins that are rattling about in big holes on Western railroads.

A Baldwin Saddle-Tank Locomotive of 1861.

BY C. H. CARUTHERS, YEADON, PA.

The first saddle-tank locomotive which the writer ever saw was a small four-wheel connected Baldwin, placed in the yard of the Detroit & Milwaukee Railway at Detroit, Mich., in April, 1861.

Fort Sumter had just been fired upon and people were so engrossed with the stirring events of the time and the certainty of civil war as to have little time to gratify the desire for information of a mere boy about that which was, to him at least, a new type of yard engine.

Returning to my home near Pittsburgh, Pa., later in the summer, one of the first objects seen in the Pittsburgh yard was a new Pennsylvania Railroad engine (No. 215) of saddle-tank type, but much larger than the one in the Detroit & Milwaukee yard at Detroit.

Later investigation showed the following leading dimensions of this engine:

Cylinders—15 x 18 inches.
Driving wheels—44 inches diameter.
Boiler—41 inches diameter.
Firebox—50 inches long inside, 35 inches wide.
Pitch of cylinders—3 in 12 inches.
Pitch of valve rods—3 in 12 inches.
Top of tank above top of boiler—22 inches.
Curved parts of tank below top of boiler—20 inches.
Width of tank over all—54 inches.
Weight of engine—64,000 pounds.
Wheel base—Total, 117 inches.
Center of rear driving axle from firebox front—11½ inches.
Type of boiler—Flush top.
Length of boiler over all—216½ inches.
Height of dome above boiler—35¼ inches.
Diameter of dome—28 inches.
Center of dome from rear of boiler—52 inches.
Bottom of boiler barrel above rail—42 inches.

Length of saddle-tank—108 inches.
Valve gear—Shifting links.
Radius of links—40 inches.
Construction No. 1006.

Although the firebox was evidently deficient in grate surface, this engine was meant to use anthracite coal or coke; but the results at that time were not exactly satisfactory, as a tender containing a supply of soft coal was soon attached and used regularly; but even this arrangement did not appear to meet all requirements, as the engine was transferred to the Eastern end of the line after a brief service.

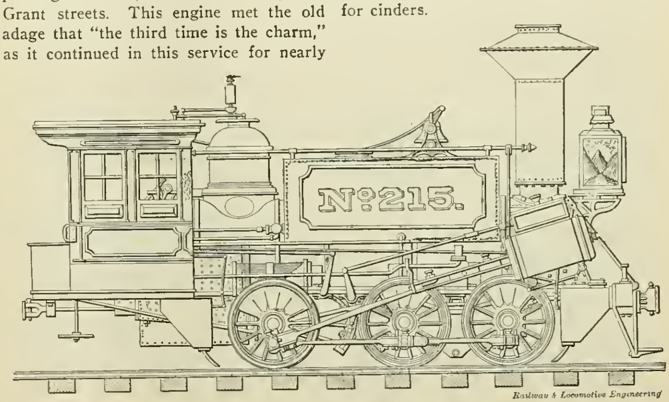
In 1863 a similar engine (No. 197) was brought to Pittsburgh, but it evidently showed little difference in performance from the "215," as a tender carrying soft coal was soon attached, and after a few months' service this engine also was taken away.

Early in 1865 another of the same type (No. 346) was brought to Pittsburgh and installed as passenger shifter at the old passenger station, corner of Liberty and Grant streets. This engine met the old adage that "the third time is the charm," as it continued in this service for nearly two years, and was used without any tender, as was intended by its designer. It finally was transferred to the freight department in the latter part of 1866, its place being filled by another saddle-tank engine of somewhat different design which, with a number of others from Baldwin and still others at later periods from the Altoona shops, gave good service until the advent of shifting engines with sloping tenders in 1871.

Fifteen engines of the type of No. 215 were built and used on the Pennsylvania Railroad, between 1861 and 1867, and the last one was retired from service in 1891. They all had the first and second pairs of driving wheels contained in M. W. Baldwin's patented driver truck, which he used on these two pairs of drivers on all engines having more than two pairs of driving wheels.

This truck is described in so many works pertaining to the development of the locomotive that it will suffice to say here that it was so made that by using axle boxes turned to fit in pedestals bored out vertically to form the arc of a circle, and rod brasses fitted into blocks in a similar manner, the engine was enabled to curve more readily than when all the drivers were in pedestals fastened rigidly to the single frame. Four sand boxes were used, two in front and two behind, and all below the level of the frame.

As to the coal bunker shown in my drawing, it is the only part about which I am not positive as to correctness. There were changes made on this feature at various times, and the drawings of the type at Baldwin's do not show this part; but I feel quite certain that that form shown approximates it closely, and not only do I recall noticing the inconvenience of climbing over the bunker to enter the cab, but am sustained by a small sketch made in water-colors of another tank engine in 1864, which was built about the same time at Baldwin's as "215." The smokestack was of diamond type, but the straight portion was double, and formed a receptacle for cinders.



OLD PENNSYLVANIA SWITCH ENGINE.

There were probably several causes of unsuccessful results in the first use of this type of engine at Pittsburgh. In the first place, anthracite coal cost rather heavily by the time it reached Pittsburgh, and the small firebox and smaller space for carrying a supply of fuel formed obstacles to the use of coke. It is highly probable that none of the yard enginemen understood how to handle anthracite coal, and also certain that few, if any, of the others possessed much information on the subject.

But one engine used coke as a fuel. It ran between the outer depot and the Duquesne freight station at the "Point," a distance of about two miles; and as at that time almost this entire distance was upon a track laid along the center of Liberty street, one of the city's busiest thoroughfares, an ordinance confined the fuel used in engines traversing it to coke, and limited the speed to four miles per hour. Excepting the regular engineman in charge, few had run this engine; hence the men experienced in the use of coke were scarce.

A Lightning Machinist.

Who do I think is the oddest character evolving from the practice of modern railroading? answered the retired M. M., why, without a doubt it is the machinist who can cover up a job. He has all the rest of them beaten by the length of a division. Of course the line of the road has its freaks in eccentric engineers and superstitious firemen, but their work is more conspicuous than that of the shopmen, and that is the reason why they get all of the prominence when the queer side of human nature is under discussion; but the shop is where you see the vagaries of personality. I want to tell you a story about the type I mentioned. You will all recognize the character, but from the standpoint of originality in his line, Pud Allan was the limit.

Nobody ever saw him sweat a drop, yet he would get away with the hardest kind of jobs in the easiest imaginable fashion. He was the hardest man to get on to I have ever met, though I solved him at last—but I am getting ahead of my yarn.

I was roundhouse foreman at Hillside in 1901, I think. The shop had thirty-two tracks and handled lots of power. Three divisions centered there, and it was necessary to get the stock out of the house almost as soon as it was in. For that reason the machinists on running repairs had to be a pretty lively lot. Unless a fellow had learned his trade right there he wasn't much good to us and couldn't hold his job very long. Often I have been obliged to give a man and his helper as many as a dozen work slips in one day. All of our engineers could write pretty well, by the way, and were adepts in covering paper, especially when they wanted their mill in the shop for a lay-off. As a rule, though, the stuff they reported ran pretty much the same—driving box cellars packed, valves examined, brasses filed and other odds and ends; but, as I said before, it had to be done quickly.

When Pud Allan drifted in there I was short two men. He asked for a job, and the Old Man told me to put him to work right away. He had the usual kit of the hobo machinist—a hammer, a pair of leg and a pair of bow calipers and a center-punch. I gave him one of the odd helpers and started him in.

Apparently he made good from the jump. He was the quickest man I ever saw in my life about a locomotive. It seemed that the time would scarcely be ten minutes after I had given him a job, when he would be standing around his vise bench with his tools wiped off. Both myself and the general foreman thought that we had struck a prize package in that chap, and we kept him going on the work in which he had demonstrated his speed. Presently, however, kicks began coming in that the work he would do didn't last very long. Mike McGill, who ran the "843," said that after Pud had raised his engine on her springs she was down as bad as ever before getting to the end of the run, and various other complaints were filed with monotonous regularity.

You know, a roundhouse foreman with all that work to get out and the fights with the yardmaster about supplying a certain number of engines—to say nothing of signing a thousand and one orders for lamp-black, headlamp chimneys and inch nuts—hasn't time to watch how every individual job is done. He has to trust his men to a certain extent, and Mr. Allan shut up my eye in good shape.

I got on to him all at once, but I did it through a prearranged plan. It was 4 o'clock on pay day evening, and as he was one of the regulars and hot after time, I knew that he didn't care about being stuck after the whistle blew. There was a bunch of slips on the hook, about as follows, I think: The "1321" wanted guides closed on the right side; the "743" wanted a left back spring thrown back from the wheel on which it was riding, and the "837" wanted an additional piece of wood put under both front and back right spring hangers to raise her. In addition to this, on the "837" I had promised old man Burns that I would put in some new bolts in his cylinder saddles, which he claimed were working, and with this bunch I approached Mr. Allan.

"Pud," I said, "I will have to get you to work awhile and clean these slips up for me. I let Corson off at 4 o'clock; Murphy's wife is sick and he has got to go home, so you are the only one I have left. You will have to work until you get them done. The cylinder bolts for the '837' are already turned up in the square shop, and if anything has to come off them you can put them in the lathe and skim them yourself."

He ran his eye over the slips and said: "Well, I will be here all night, I guess; these are big jobs." When I went home at 6 o'clock I told McAvoy, the night foreman, to hold the engines in until morning, as I wanted to look them over.

When I came down the next morning Allan had finished up the entire business. He had put in an overtime card for a day and a half, and was sleep on some waste in the oil house. First I went around and sized up the "837." Much to my surprise I saw that both cylinder saddles had been apparently rebolted all around, as several rows of new nuts testified. It was so seemingly preposterous that a man could do such a big job in that time that my suspicions, already aroused, were confirmed that it was not on the level. There was a 1⅛-inch wrench lying around and I removed one of the new nuts. It was on no new bolt, though. On every one of those old ones Allan had screwed a new nut, and the general effect was most pleasing. Subsequent investigation revealed that not a single bolt had been removed. All had worked so bad that they had to be drilled out eventually. Then I

took a glance at the spring hanger under which I had ordered an inch piece of wood to be placed. From the edge of the pit the new piece was plainly visible—that is, the new edge of it was. I knew that there were two pieces under each hanger on the night before, because I took particular notice to that effect. There was still the same number, only the expert at covering up had very cleverly split the edge of the lower piece with a chisel to make it look new.

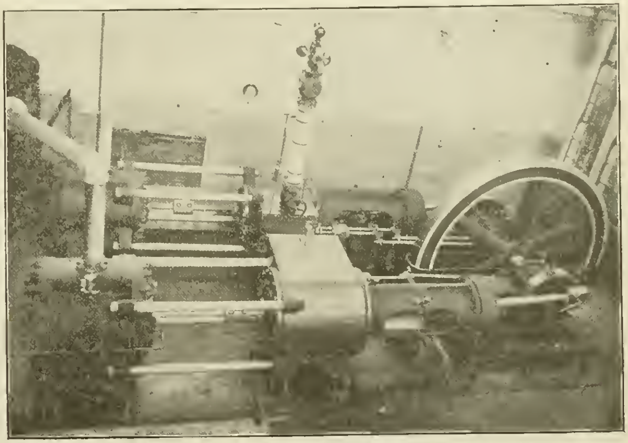
So much for the "837," but the limit was reached on the "1321" and the "743," the other two mills that I had left in his care. The guides which I told him to close on the former were of the four-bar variety and the crosshead had brass gibs. Instead of taking the liners out of the guides, Mr. Allan had contented himself with jumping the edge of the gibs up with a calking tool until they met the upper guide bar. Then he had nicely scraped off the entire business with a scraper. It made a beautiful job to look at.

Passing around to the "743," I ran my hand between the wheel and the edge of the spring that rubbed and saw that it no longer touched. I thought at once that I had discovered a job on the level, that the saddle had been jacked out of the box and a piece of steel put under the low side; but no. A little examination showed that the spring had been pried over with a bar and a ½-inch nut placed between it and the tire to hold it off and fool a casual inspector.

It was with a feeling almost of regret that I wrote an order for Allan's time a few hours later. It was certainly with admiration of so much misdirected ability. He told me years afterwards, that, from the time he was an apprentice, he had never done a job on the level in his life and had gotten away with his subterfuges nine times out of ten.

A Large Compressor.

The accompanying illustration represents a Class D. S. C. Air Compressor having duplex steam cylinders and two stage-air cylinders, with inter-cooler, built by the Franklin Air Compressor Works of the Chicago Pneumatic Tool Company, with offices in the Monadnock Block, Chicago, and No. 95 Liberty street, New York, installed in the Brooks plant of the American Locomotive Company at Dunkirk, N. Y. This compressor has steam cylinders 20-inch diameter by 24-inch stroke, low pressure air cylinder 27-inch diameter by 24-inch stroke, and high pressure on cylinder 16½-inch diameter by 24-inch stroke, representing a piston displacement of 1,580 cubic feet of free air per minute at a working speed of 100 revolutions. The illustration herewith presented is the first



LARGE FRANKLIN AIR COMPRESSOR.

of this type of machine that has appeared in the press, it being especially noteworthy that the compressor demonstrated under test one of the most efficient performances ever attained by a compressor of this type and capacity. Similar compressors have recently been installed at the shops of the New York Central and Hudson River Railroad Company, at Depew, N. Y.; Lake Shore and Michigan Southern Railway Company, at Collinwood, O.; New York, New Haven and Hartford Railroad Company, at New Haven, Conn.; Delaware, Lackawanna and Western Railway Company, at Kingsland, N. J.; Terre Haute and Indianapolis Railroad Company at Terre Haute, Ind., Norfolk and Western Railroad Company at Roanoke, Va., Erie Basin Dry Dock Company, Brooklyn, N. Y.; United States Navy Yard, Boston Mass. (Three machines.) The Manufacturers build this type of compressor in a number of sizes, and also duplex and single types, both steam and belt driven.

To meet the demand of increasing business the Merwarth Metallic Gasket Co. have moved from 107 Liberty street into larger quarters in the Beard building at 120 Liberty street, Rooms 604 and 605.

We have been favored with a copy of a new book by Prof. W. F. M. Goss called "Locomotive Sparks," and published by John Wiley & Sons. Needless to say it is both interesting and thorough. An adequate review will be published in a later issue.

One of the neatest little booklets of the month is "Mechanical Draft," which is number 46 of the B. F. Sturtevant Company's bulletins. It is artistic in appearance, convincing in argument, and should be read by every one responsible for power plant economy.

The Union Pacific Railroad Company have decided to operate in future their dining-car service. The Pullman Company have for several years owned and operated the dining cars on the Union Pacific, but the service was not satisfactory, hence the change.

At the present increasing speed of passenger transportation, we may expect before the end of the present year to reduce the time required to journey around the world by nearly two weeks—one week over the Siberian railway, a day or two in Europe, one on the Atlantic, one across the American continent, and perhaps three days on the Pacific.

March comes in this year like a lion and went out like a whale for its end and the beginning of April witnessed more dangerous floods than the oldest inhabitant has seen equaled. Railroads suffered very severely and the floods were extended over an unusually wide area. It is not often that a deluge covers most of the country from the Dakotas to Louisiana.

An attractive little booklet called "Who Says So?" has been received from the manufacturers of the Kincaid Locomotive Stoker. The purpose of the booklet is to show how generally practical railroad men recognize the necessity of a mechanical stoker in order to promote needed economies and reforms in the operating department of the leading railways. Opinions of a large number of prominent railroad men are quoted to tell the uninformed "who says so."

The Cincinnati Milling Machine Co., Cincinnati, O., have just issued a new 1902 catalogue, showing their new line of milling machines. This is a very handsome piece of book-work—illustrations being in half-tone throughout. A number of interesting improvements are illustrated and described in detail; among these, their New All-Gear Feed Mechanism, whereby all feed changes are instanty obtained by movement of lever, the drive being always positive, permitting much heavier and faster cuts than the old belt-fed mechanism.

Officials of the Illinois Central road have decided to use electricity for switch and signal lamps at all terminals where the necessary power can be obtained. The decision was reached after a series of elaborate experiments conducted in the Chicago yards and terminals. At present contracts have been let for the equipping of the terminals at Chicago, Fulton, Fort Dodge and Iowa Falls. Incandescent lights will be used. The Illinois Central is the first road to adopt electricity for signal lamps and the result will be watched with interest.

Undoubtedly one of the most prominent improvements in up-to-date locomotive construction is the use of cast steel in the various engine parts. A few years ago a skeleton cast steel wheel, rocker-arm, eccentric strap, driving, box and other now familiar steel parts were exceedingly rare, and even unknown. To-day, cast steel has almost entirely replaced cast iron, even entering largely into such heavy castings as cylinders, etc. Nor has cast iron alone given way to steel. Many parts that were formerly forged of iron are now made of cast steel, and truly, steel seems to be king.

Rumor has been very busy for the last month with reports that the Erie interests are planning to secure control of the Cincinnati, Hamilton and Dayton. The latter road is a most valuable property, and its absorption by the Erie would lead to radical traffic changes would result. The through passenger train line of the Monon between Chicago and Cincinnati is now formed by its use of the Cincinnati, Hamilton and Dayton into Cincinnati. If the Erie should obtain control of the profitable Ohio system it would mean a break between the Cincinnati, Hamilton and Dayton and the Monon.

Yes, said the western man, there are several patches of country still left out our way that will support a few million people each. There is a little section up in Wyoming, for instance, known as the Big Horn Basin, which has just been opened up by a new line of the Burlington Railroad. It covers about 50,000 square miles. It's larger than New York State. Three times as large as Denmark. Twice as large as Bavaria. It is covered with beautiful streams, a never-failing water supply and the soil is as rich as any in the world. The possibilities for irrigation there are enormous and three big irrigation ditches are built already. Oh! yes, there are a few scraps of real good country left. We won't be crowded off the earth yet awhile.

INDEX TO ADVERTISEMENTS.

Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XV. 174 Broadway, New York, June, 1902 No. 6

Two Large Rogers Locomotives.

Among the recent locomotives turned out by the Rogers Locomotive Works, Paterson, N. J., was a lot of 15 Consolidations for the Erie, one of which we illustrate herewith. The firebox is one of "high Wooten," as they are sometimes called, the grate being 8 feet wide and 9½ feet long, giving 76 square feet of grate area.

It has a clean cut look for an engine of this class and weight, some of which lack this characteristic. It will be noted that it is well supplied with sanding apparatus and that the main reservoirs are over the firebox end of the boiler. Piston valves are used. The leading dimension areas follows:

Cylinder—22x30 inches.

Drivers—Diameter, 56 inches.

Driving axle journals—Main, 9½x12 inches; others, 9x12 inches.

Driving wheel base—17 feet 0 inch.

Total wheel base of eng.—25 feet 4 inches.

Weight on drivers—130,000 pounds.

Weight on truck—20,000 pounds.

Weight, total—200,000 pounds.

Heating surface—Tubes, 3,288 square feet.

Heating surface—Firebox, 235 square feet.

Heating surface, total—3,523 square feet.

Tubes—2 inches; length, 15 feet 4¼ inches.

Tubes—Number, 410.

Boiler—Diameter, outside front, 76⅛ inches.

Boiler—Working pressure, 200 pounds.

Boiler—Thickness of barrel, 13-16 inch.

Engine truck—Wheels, 30 inches.

Tender—Capacity, 12 ton coal; 6,000 gallons.

Tender—Wheels, diameter, 33 inches.

The Prarie type of engine under its various names (Lake Shore, Marshall, etc.) seems to be rivaling the Atlantic (also known as Chataqua, Central-Atlantic, etc.) in popularity. The one shown is for the Illinois Central, and has 75-inch drivers, with cylinders 20 by 28 inches.

As will be seen, both injectors are on the engineers' side and the sanding device is double pneumatic. The details are shown in the line engraving as well as those of the hangers of the trailing wheels. These need little explanation, being modifications of the regular swing truck. Illustrated on pages 261 and 264.

The main dimensions are given below.

Fuel—Bituminous coal.

Driving axle journals—9½x12½ inches.

Driving wheel base—13 feet 6 inches.

Total wheel base of engine—30 feet 9 inches.

Weight on drivers—130,000 pounds.

Weight on truck—21,500 pounds.

Weight on trailers—23,500 pound

Total weight—175,000 pounds.

Heating surface, tubes—3,333.25 square feet.

Heating surface, firebox—201.26 square feet.

Heating surface, total—3,534.51 square feet.

Grate area—51.08 square feet.

Tubes—Diameter, 2 inches; length, 19 feet 0 inch.

Tubes—Number, 335.

Grate—Length, 102 inches; width, 72 inches.

Boiler—Diameter, outside front, 68 inches.

Boiler—Working pressure, 200 pounds.

Tender capacity—15 tons coal, 7,000 gallons.

Tender wheels—Diameter, 38 inches.

ROGERS 100-TON CONSOLIDATION FOR THE ERIE R. R.

Heat and Motive Power.

Sixth Paper.

BY ANGUS SINCLAIR.

In an article published in June, 1900, I briefly followed the development of the steam engine up to the time that Watt had ceased to work upon it. When Watt began his work of improving the steam engine he found the most perfected forms of Newcomer engines pumping water and performing about 120,000 foot pounds of work for each pound of coal used for steam making. By the time Watt retired from business his best engines were doing a duty of 350,000 foot pounds per pound of coal.

Before proceeding to tell about the work done by Watt's rivals and successors, to develop the steam engine, I must turn back to say something about what was done by a French military engineer whose work on the steam engine is scarcely ever mentioned.

THE FIRST HIGH PRESSURE STEAM ENGINE.

In the year 1769, when Watt was trying to improve on Newcomer's atmospheric engine by using a separate condenser to prevent the loss of heat that resulted from condensing the steam every stroke in the main cylinder, Nicholas Joseph Cugnot designed and had built in Paris a steam carriage which he supposed could be used as a gun carriage. The carriage was tried in the presence of the Duc de Choiseul, Minister of War, and of other influential courtiers of the French government. Like most first attempts this steam engine was not a success, but the inventor was encouraged to try again and he produced a second engine which is still preserved in the Conservatoire des Arts et Metiers, Paris, a museum where a great many interesting engineering inventions and curiosities are preserved, some of them being of particular interest to Americans. I have examined the engine very carefully several times and consider that it was a wonderfully well designed and substantially built motor, much superior to the first high pressure engines built in England thirty years afterwards.

DESCRIPTION OF CUGNOT'S ENGINE.

Cugnot's engine, shown in the annexed engraving, is a tricycle with a heavy frame consisting of two strong wooden beams set parallel and extending from end to end, to which the wheels and running gear are secured in a most substantial manner. The single wheel is in front and carries the engine and boiler. It has blocks on the periphery for the purpose of biting the ground and preventing slipping, a very necessary arrangement for the adhesion would not be sufficient to hold down much tractive force. The single wheel is turned by two single acting engines, one on each side, which operate ratchets that convert the reciprocating motion of the pistons into rotary motion. This arrangement was tried by several improvers of pioneer steam engines before they realized that the crank, whose action in connection with the turning lathe is as old as civilization, was the simplest way to convert to and fro motion into circular motion. To me the boiler seems to be the most defective part of the apparatus. It is made in the form of the cooking caldrons used in the kitchens of feudal castles in olden times. As may be noted, the vessel is a section of a truncated cone made of copper sheets riveted together. At the bottom is a small furnace which was undoubtedly too small to supply steam for more than a few minutes when the engine was working. This shortcoming doubtless proved that the motor could not perform the work for which it was intended.

Zerah Colburn, speaking of this engine, says: "It has a good sized copper boiler, poorly contrived, however, for the rapid generation of steam, and it has a pair of 13-inch single-acting cylinders, and a single driving wheel 4 feet 2 inches in diameter and 7 inches broad at the tire. We speak of this engine in the present tense because it is at this moment fit for service, although its performances would not be likely to compare advantageously with those of modern locomotives, combining arrangements of which it is possible that Cugnot had some idea without having hazarded an experiment upon them. The framing of the engine is in two parts, joined together by a swiveling pin at *e*, exactly over the driving wheel *m*. The hinder framing, *t*, intended for the support of a load of nearly 5 tons, is mounted upon a pair of large wheels, *r r*. The front frame supports the boiler, *c*, and engine. The boiler has a fireplace, grate bars and ash pit at the bottom, and two rectangular flues, serving as chimneys, which rise vertically through the water space. A steam pipe, *o*, conveys the steam to a pair of single-acting cylinders, *a a*, the admission being effected by a four-way cock, *w*. The pistons in these cylinders have rods working downwards, and connected with pawls, *f*, engaging with a ratchet wheel, *c*, on the driving axle, each stroke of one piston turning the driving wheel one-fourth of one revolution. The two pistons are so connected together that the descent of each causes the ascent of the other, and an effective if not elegant

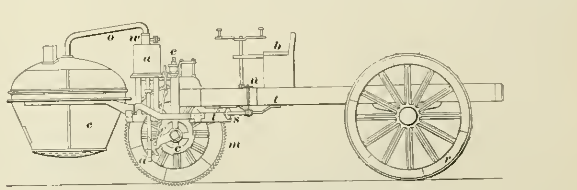


Fig. 2. - Cugnot's Locomotive, 1771.

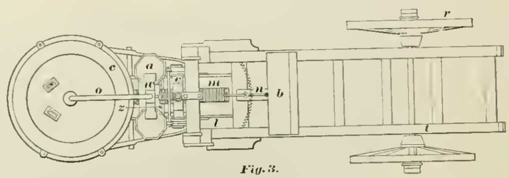


Fig. 3.

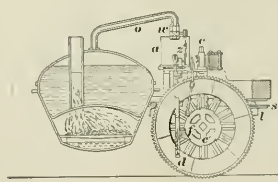


Fig. 4.

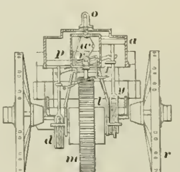


Fig. 5.

CUGNOT'S ENGINE.

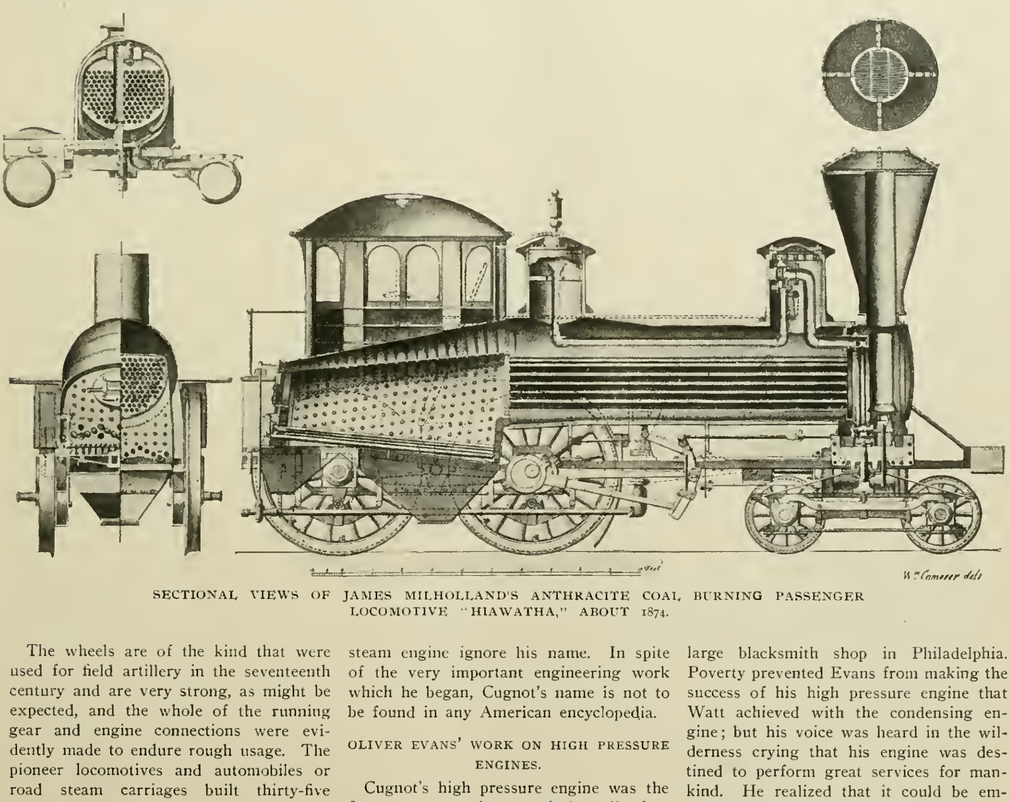
connection is made between the piston rods and the four-way cock, *w*. The steering gear is exceedingly simple and effective, and the driving apparatus is arranged to work the engine in either direction, the progressive motion being obtained entirely from the adhesion of the driving wheel, *m*, to the ground, the tire being roughened to increase its 'bite.' If we take the weight of this engine and its intended load as 12 tons, and its speed at 2¼ miles an hour on a level, it would have about 5 actual horse power. The resistance at the periphery of the driving wheel may be estimated as 840 pounds, and with a 13-inch stroke of the pistons this would require a pressure of 19 pounds per square inch above the atmosphere, and this, therefore, may be taken as about the

datum upon which Cugnot's calculations were made. The engine, it appears, was tried but two or three times, for, having accidentally overturned in the neighborhood of which the Madelaine is now the center, it was immediately locked up in the arsenal, and all hopes of its ultimate success apparently abandoned. The engine in its present state bears evidence, however, that even under the most favorable circumstances it could not compete commercially with horse power; and when we recall the generally wretched state of the roads, alike in France and in England, in the last century (18th) we have abundant reason for the discredit which then attached to all schemes for steam locomotion."

The wheels are of the kind that were used for field artillery in the seventeenth century and are very strong, as might be expected, and the whole of the running gear and engine connections were evidently made to endure rough usage. The pioneer locomotives and automobiles or road steam carriages built thirty-five years afterwards in Great Britain caused great annoyance, expense and delay through the parts being too weak and failures happened so frequently that the introduction of steam into land transportation was delayed for years, but there was no fear of Cugnot's carriage breaking down on account of structural weakness.

The political troubles that were brewing in France about the time Cugnot's carriage was tried gave the military engineer something to do which was considered more important than the work of experimenting with a steam engine. Cugnot lived till 1804 and saw other forms of steam engines made a commercial success.

So far as the mechanical part was concerned, Cugnot's high pressure steam engine possessed all the valuable elements of those that were afterwards made successful by others. Cugnot, like our own Oliver Evans, worked out the problem of improving the Newcomen atmospheric engine into a high pressure steam engine. Had Cugnot been an Englishman, he would to-day be credited with being the inventor of the high pressure steam engine. But having been a Frenchman, encyclopedia writers on the history of the steam engine ignore his name. In spite of the very important engineering work which he began, Cugnot's name is not to be found in any American encyclopedia.



SECTIONAL VIEWS OF JAMES MILHOLLAND'S ANTHRACITE COAL BURNING PASSENGER LOCOMOTIVE "HIAWATHA," ABOUT 1874.

OLIVER EVANS' WORK ON HIGH PRESSURE ENGINES.

Cugnot's high pressure engine was the first one to receive practical application, but Oliver Evans did much more to further the development of this type of engine. This great inventor who was a native of Delaware, was born about 1755, received a country school education and passed through a wheelwright apprenticeship. He was a born mechanical genius and possessed in a high degree the inventive faculty with an analytical turn of mind which readily perceived the shortcomings of any apparatus and the lines on which it might be improved.

Early in life Evans had the opportunity of examining a Newcomen engine. After studying the working of the machine he remarked that it would be better to use the pressure of the steam direct for driving the piston, instead of providing the means of creating a vacuum in the cylinder to utilize the atmospheric pressure as a means of performing additional work.

EVANS' ENGINE.

He proceeded to design an engine on this idea, and in 1786 he applied to the legislature of Pennsylvania for a patent on the engine, but it was refused. He afterwards built several engines which were employed on mill work, and I saw one of them in 1884 driving the fan of a large blacksmith shop in Philadelphia. Poverty prevented Evans from making the success of his high pressure engine that Watt achieved with the condensing engine; but his voice was heard in the wilderness crying that his engine was destined to perform great services for mankind. He realized that it could be employed to propel ship and to drive railroad trains, and he did all in his power to make the world of his day understand the benefits his invention was destined to perform in abridging the distances on this great continent.

The Columbian engine built by Evans had a single vertical cylinder which transmitted movement to a horizontal beam supported on one end by a rocking column which was connected to a main rod that transferred the power to a crank. The "Columbia," as shown in all pictures

had a peculiar valve motion actuated by spur gearing which received motion from the driving axle. The engine which I saw had a valve driven by an eccentric.

EVANS' PREDICTIONS ABOUT INLAND TRANSPORTATION.

In Evans' time the question of inland transportation was beginning to receive much attention from scientific and intelligent citizens in all the larger cities. Philadelphia, which has always nurtured the men of this nation most progressive in art and science, appeared to be a center of engineering investigation, and Oliver Evans did his best to keep the people of that city thinking about improved methods of inland transportation.

It is now about a century ago since Evans told people that his engine would propel boats against the current of the Mississippi and move wagons on turnpike roads. Later he made the memorable prediction "A carriage will start from Washington in the morning, the passengers will breakfast at Baltimore, dine at Philadelphia and sup in New York." Evans was an inventive genius and one of the seers of mankind whose vision penetrated the gloom of the future, but his labors and aspirations were strangled by adverse conditions.

"Chill penury repressed their noble rage
And froze the genial currents of the soul."

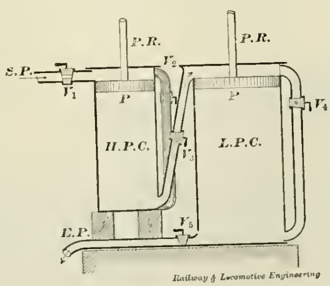
But Evans did not waste his life on saturnine complainings or permit his disappointments to generate resentment towards his fellow men, as has happened so often with inventors whose work has not been justly appreciated. He devoted himself to various mechanical pursuits and labored very successfully on the improving of milling machinery and in extending the use of his steam engine. He wrote "The Young Steam Engineer's Guide" and the "Young Millwright's Guide," both books having the best authority for practical men in their day. Had Evans met a powerful coadjutant such as Watt enjoyed in Boulton, the world would now be according Evans proper credit for his work on the improving of the steam engine.

WATT'S FAR-REACHING PATENTS.

James Watt covered the field of practical and possible inventions for improving the steam engine so thoroughly with letters patent, that he almost completely suppressed the efforts of others who wished to introduce inventions intended to increase the efficiency of the steam engine.

There is a disposition on the part of people in the British Isles, to consider that an individual or a firm that originates and builds up a new business has a sort of vested right in it, apart from any legal protection provided by law. Watt and his friends made the most of the privileges accorded to them as engine builders, and they savagely prosecuted everybody who dared to build steam engines or their attachments of forms that came within sight of infringing Watt's far-reaching patents. A rival inventor was looked upon as a robber, and it is wonderful how many people, in no way connected with the engine builders, took part against other inventors in that line. Thirty years after Watt's death John Bourne, author of an admirable history of the steam engine called some of Watt's competitors pirates because they tried to develop inventions that had been proposed by Leupold twenty years before Watt was born. In 1825 Stuart, author of "Anecdotes of the Steam Engine," referring to Jonathan Hornblower, wrote, "it must always be a subject of regret that this ingenious man should have wasted the best part of his life and ruined his fortune in a series of selfish attempts to copy Mr. Watt's inventions, without coming within the letter of his patents."

There were very few improvements effected on the steam engine during the life



CYLINDERS OF FIRST COMPOUND ENGINE.

of Watt's patents that did not originate in the Soho Works. Many people believed that Watt's grasp of the steam engine was omniscient and that other men who tried to improve the engine wasted their time. A few engineers held different views, however, and one of them, Jonathon Hornblower, was a most persistent rival. He invented the first compound engine, and he was the first inventor to patent an engine in which claims were made for advantages to be derived from steam used expansively.

THE FIRST COMPOUND ENGINE.

The annexed engraving, taken from Stuart's "History of the Steam Engine," illustrates the cylinder arrangement of Hornblower's compound engine, and it will interest our readers as being the first invention of a type of engine which has become so popular of late years. Both pistons were connected to a walking beam and moved together. They are shown at the top of the cylinders drawn there by the weight of the pump rod at the other end of the walking beam. In starting the engine the valves $V1$ and $V3$ are opened and $V2$ and $V4$ are closed, when the steam from the boiler enters through S P above the H P C piston. At the same time the valve $V5$, in the eduction pipe, is open, cold water is applied to a surface condenser which creates a vacuum, and the engine makes a stroke. When $V2$ and $V4$ are opened, and $V1$ and $V3$ shut, a communication is established between each side of the respective pistons, and as an equilibrium of pressure is thus produced, the pistons rise again and are ready for another stroke. Means were provided for operating the valves to suit the events of the stroke.

It will be noted that the engine was single acting, a very common arrangement in those days, but it embraced all the elements of the modern compound engine. A novel feature about this engine was that a surface condenser was employed for the first time in connection with a steam engine.

Hornblower built several of these compound engines and put them to work principally on the pumping of water, but none of them was successful. Hornblower had advanced ideas about the advantage of using steam expansively, but the boiler pressure of 10 or 15 pounds above the atmosphere, then common, did not provide a sufficient range of tension to justify the use of a second cylinder. It is now well understood that one of the principal advantages of compounding is that it limits the range of the temperature of the steam used in the cylinders, thereby keeping down the heat losses due to cylinder condensation. The difference between the initial and the exhaust temperature of the Hornblower engine was so limited that the heat saving effected by dividing the pressure in two cylinders must have been very trifling, and the gain from expansion of the steam could have been obtained in a simpler fashion by expanding in a single cylinder.

Although Hornblower's efforts to improve the steam engine were not crowned with success, he indicated a line of progress that others subsequently followed to honor and glory. A very different fate was reserved for Hornblower. He was prosecuted by Boulton & Watt for infringement of their patents, the court decided against him and inflicted a heavy fine and the payment of royalties. Being unable to pay, the inventor was imprisoned and suffered many of the indignities so notorious in the indigent debtor prisons of the period. He died a broken and impoverished man.

The Chicago Great Western Railroad Company are displaying a great deal of enterprise in extending and bettering their property. Among promised improvements is a cut-off which will shorten the distance between Chicago and Omaha ten miles. About $1,200,000 will be expended on construction and betterments this season.

How They Treat Flood Sufferers in Turkey.

The North American continent was not the only region which has suffered from disastrous floods this spring. Mr. W. E. Curtis, of the Chicago *Record-Herald*, recently sent a letter from Constantinople describing some incidents of the floods in Turkey and giving some amusing information about how flood sufferers are treated on Turkish railways. The Orient express, which he mentions runs every second day between Paris and Constantinople is supposed to be one of the most luxurious trains in Europe, although it compares very unfavorably with any of our through trains carrying sleeping cars. During one trip which the writer made on that train from Vienna to Paris it seemed that nearly all the men were lying with their clothes and even their boots on.

The people in charge of the train seem to be cudgling their brains all the time to put new and annoying impositions upon passengers. The floods afforded them a golden opportunity which seems to have been worked for all it was worth. Mr. Curtis writes:

There has recently been a flood up the country between Constantinople and Budapest, and a large section of track was washed away. The trains going west returned to Constantinople, but the trains coming east from Budapest and Vienna were not notified of the obstruction and were allowed to start as usual and accumulated at the washout, where there were no accommodations for the passengers, no place for them to eat or sleep. When the cars were finally sent back to Adrianople, the nearest town, the passengers were compelled to pay full fare to that point. The mails for several days were allowed to accumulate at the washout and were held there for nearly three weeks, when they might have been taken back a few miles to Adrianople and sent around by another route, via Bukharest, but no one seems to have thought of it, although such accidents and interruptions of traffic occur every year.

Passengers by the Orient express, which is the most expensive train in the world, were carried to the washout. Tickets were sold to London, Paris, Berlin, Vienna and other distant points and full sleeping car fare was collected and all tickets are limited to one day—the date stamped upon them. The railway company would not extend them or refund the money or give rebates, and even compelled the passengers who were carried to the blockade to pay not only the regular fare, but what is termed a "speed supplement" charged upon express trains, and also the full sleeping car rates. Those who attempted to secure a rebate or the return of their money were calmly informed that it was not the practice of the railway company to redeem its tickets, and persons who started for London and other places by the first train after the break was repaired were compelled to buy new tickets and pay again the regular sleeping car charge and the "speed supplement."

The Inventor of Pneumatic Tube Transmission.

Nearly all mechanics and engineers who use compressed air for the transmission of power imagine that the using of it for such purposes is something new, but that is not correct. To be sure its use for mechanical purposes has been greatly developed since George Westinghouse used it for transmitting power to brakes, but it is more than one hundred years ago since William Murdock, so closely associated with James Watt, transmitted power through the engine works at Soho, near Birmingham. He drove the machinery of several shops by air compressed by the blowing engine, and he built a lift which also was operated by compressed air. Among other purposes to which Murdock applied compressed air was the transmission of packages through tubes. He was really the inventor of the pneumatic air tube transmission which has been used so successfully of late years.

To Prevent Strikes in Canada.

The Dominion government has introduced a bill into the House designed to settle in Canada all railway labor disputes and strikes by compulsory arbitration. This applies to the difficulties arising between the railroads and the employees. The bill makes strikes and lockouts illegal and includes all steam and electric roads including those owned by the governments, making the offenses above named illegal and punishable.

The matters will be handled by provincial boards. In case the matter in question is not wholly in one province, it will be handled by the Dominion board. The provincial boards will be composed of three members, one chosen by the employers, one by the boards and the third by these two. In case these two cannot agree on the third, he will be chosen by the governor in council.

The Dominion board is to be composed of five members, two elected by the representatives of the railway owners on the seven provincial boards, two by the employers' representatives on these boards, and the fifth by the other four, or by the Dominion government. Each employee has one vote. The elections are to be held every three years, that being the limit of time each member of an arbitration board serve. Awards are to be current for one year, or until superseded by another award of the same arbitrators.

It is also provided that no court shall have power to review, amend or quash awards. The bill will not be passed by Parliament this year, it being desired to first make the country familiar with its provisions, and to receive suggestions from all parties interested. Next year the measure will be pressed to a conclusion, with such amendments and alterations as may be found necessary.

Too Credulous.

"Congratulate you on the fine reception which I heard you were honored with out in Indiana," some one yesterday remarked to Senator Fairbanks, who had just returned from the Republican Convention in Indianapolis.

"That reminds me," said the Senator, "of an old but always good story. In a sleeping car a man was snoring most loudly and nobody else in the car could sleep. Finally it was decided to awaken him and compel him to quit snoring or stay awake. So after much difficulty, he was aroused.

"What's the trouble?" he asked.

"Your snoring keeps everybody in the car awake and it has got to stop."

"How do you know I snored?" questioned the disturber of the peace.

"We heard you," was the reply.

"Well," said the man who snored, as he turned over to go to sleep again, "Don't believe all you hear."—*Washington Post.*

Advice Gratis.

The following poster is to be seen in a station at Pittsburg, being designed to give consolation to chronic kickers:

"If trains are late be patient and 'go way back and sit down.' Remember the old adage, 'Everything comes to him who waits,' and don't make yourself conspicuous and everybody else nervous by 'throwing down' the road. The company is just as anxious to have the trains on time as you are.

"If you think you are short-changed or have lost a mile, don't get out your hammer. A kindly word to the agent will fix matters if an error has been made. If you get more change than is due you, please make good, because the agent needs the money.

"If you see cuspidors around, kindly bear in mind that there should be no spitting on the floor. If you see the agent is busy with the questions of a brother who may be just as rushed as you are, be considerate, 'tis your turn next. Don't grunt, growl or grumble. Don't be a knocker.

"If you can say a good word, say it like a prince. If you are full of bile and disposed to say something mean, keep your mouth shut. Don't be a knocker. No man ever helped himself up permanently at the expense of his neighbor. Give up a kind word. Give it liberally. It won't cost you a cent and you may need one yourself some day. You may have thousands to-day and next year be without the price of a shave. So don't

be a knocker. You can't afford it. It won't pay. There is nothing in it.

"If you must kick, go around behind the station and take a good kick at yourself; for when you feel that way you are the man who needs it. Always remember that no man is the whole show. Be careful, therefore, and don't be a knocker."

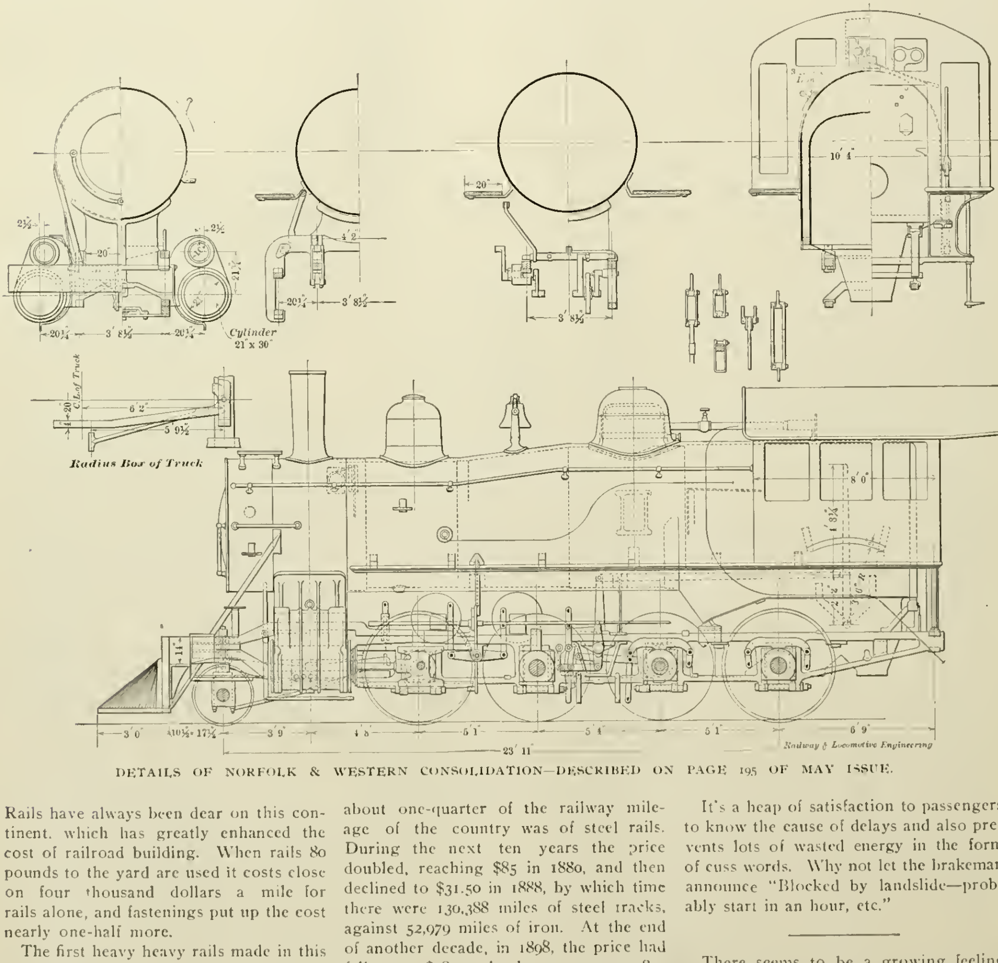
About Iron and Steel Rails.

Steel rails sell at from $28 to $30 a ton and cost considerably less than half that sum, which enables the Steel Trust to make a little more than a living profit.

Rails have always been dear on this continent, which has greatly enhanced the cost of railroad building. When rails 80 pounds to the yard are used it costs close on four thousand dollars a mile for rails alone, and fastenings put up the cost nearly one-half more.

The first heavy heavy rails made in this country were iron, of course, and were rolled in 1844 at the Mount Savage rolling mills in Alleghany county, Maryland. The first rail rolled was of U pattern and the Franklin Institute of Philadelphia awarded a silver medal to the makers. The first steel rails tried were introduced in 1866 and cost $200 a ton. Engineers did not at first regard steel rails with favor, but after a trial they forced themselves into use, but many railroad managers could not see where there could be economy in using steel rails at the enormous price charged for them. The development of the Bessemer steel process gradually reduced the price of steel until that material pushed iron out of use.

A statement published two years ago by the *Railway Age* says: "In 1868 rails sold at $174 a ton, but even at this price a few railway companies had decided that it was economy to begin to use them instead of iron. Ten years later, in 1878, the price had dropped to $41.50, and about one-quarter of the railway mileage of the country was of steel rails. During the next ten years the price doubled, reaching $85 in 1880, and then declined to $31.50 in 1888, by which time there were 130,388 miles of steel tracks, against 52,979 miles of iron. At the end of another decade, in 1898, the price had fallen to $18, and there were 220,800 miles of steel tracks; only about 24,000 miles of iron remaining. The following year, 1899, saw nearly 9,000 miles of steel added, although, in the course of the year the price had almost doubled. To-day the mileage of steel is about 230,000, as compared with 20,000 of iron—that is, 92 per cent. steel and 8 per cent. iron—and the battered relics of the iron age that still linger in scattered sidings and spur tracks will soon disappear. Although the price, $26, fixed by the mills for the coming year, is an advance of $8 over the price at the commencement of 1899, it is less than the average quotation for that year. But it is a higher figure than the large purchasers expected to pay, and if maintained may somewhat diminish the amount of new construction and renewals which had been planned on the expectation of a lower price. Still, compared with $174 a ton, even $26 seems cheap."



DETAILS OF NORFOLK & WESTERN CONSOLIDATION—DESCRIBED ON PAGE 195 OF MAY ISSUE.

It's a heap of satisfaction to passengers to know the cause of delays and also prevents lots of wasted energy in the form of cuss words. Why not let the brakeman announce "Blocked by landslide—probably start in an hour, etc."

There seems to be a growing feeling among engineers that the saving of oil is being overdone. There is not such a broad space between the extremes of actual waste and actual need, and it is equally wrong to approach too closely the one extreme as the other. Brains and judgment will do much to properly conduct the economical use of oil.

Good Work of a Tandem Compound.

Our readers will remember the tandem compound illustrated in our issue of October, 1901, and will be interested to know of its good work. Now that tandems are the style it is well to be posted on the different designs, and we repeat the drawings as they are somewhat different from the design of tandem usually seen.

Balanced slide valves are used with inside admission on the high pressure and outside admission on the low pressure. This does away with the necessity of crossed steam ports. Live steam enters at end of valve chamber and goes only to high pressure chest unless the by-pass valve is turned so as to open port giving low pressure cylinder live steam for starting, as is shown in cut. Steam is admitted to valve through center of balance plate. The low pressure cylinder exhausts through center of valve and balance plate. In this case the high pressure is not doing work as the steam is on both sides of the piston. In starting (and this is common to all the tandems) the low pressure (27 inches in this case, is getting boiler pressure and can start a train without difficulty. This is one feature that makes the number 1,705 popular with the engineer on the Baltimore and Ohio, as it can take its full tonnage out of the yard without a helper, but, of course, the boiler would not make steam enough for this except at low speed. As the boys express it, "It seems as though there was another engine pushing behind" when they throw it into "simple."

Another convenience is the ease of taking out pistons for examination of packing rings. The low pressure end of the sleeve between cylinders is loosened by removing bolts—and after slacking up on the packed joint on the high pressure head, the sleeve is pushed right into high pressure cylinder. This makes a very neat design but if all the engines are like the one in question it will not prove as useful as might be imagined, for our best information is that although the engine has been in constant use for nine months it has never been necessary to remove a cylinder head or examine the valves in that time. Considering that the engine has received no favoritism this is a good recommendation.

It will also be noticed that in drifting the engineer can raise the balance plate from the low pressure valve, thus giving a by-pass the whole size of the cylinder ports. This is so effective that the engineers report it as "drifting as easy as a box car and fanning the fire less than a simple engine."

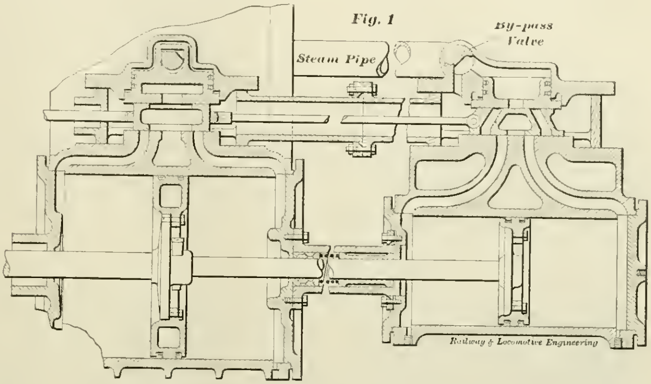
As a rule too little attention is paid to by-pass valves and some that have been used are altogether too small to be effective. One case comes to mind where they were used and then discarded. On figuring up the effective area it was found to be a little over one square inch for a 35-inch cylinder. It is no wonder that it was not an entire success.

Another test is also at hand where a cross compound with a by-pass or "drifting valve" was allowed to drift down to a 90-foot grade and would not run over 8 miles an hour on account of compression in the low pressure cylinder. Then the valves were taken out leaving an opening of four square inches at each end of cylinder.

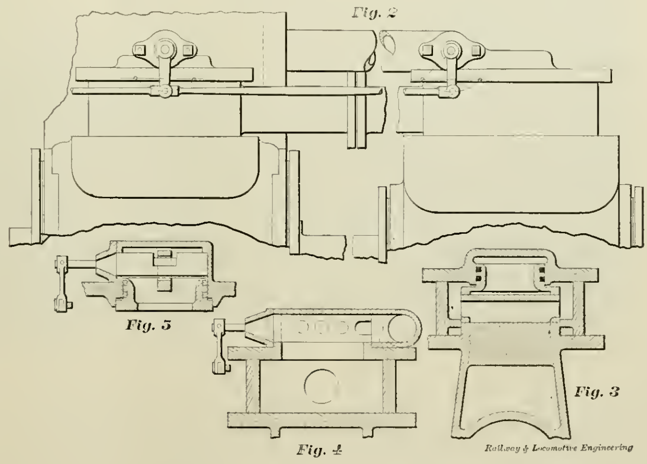
This allowed the speed to increase to 20 miles an hour but the noise made by the air rushing in and out of the small openings could be heard a mile. Finally the low pressure side was disconnected and the engine would drift at any speed it was safe to run.

As a result of this test, the low pressure cylinders was equipped with a four-inch pipe (about 12½ square inches) from one head to the other and a plug cock in the center. This added greatly to the clearance but the engines would drift like a simple engine.

This demonstrates the necessity of a suitable by-pass on any large cylinder, whether simple or compound, and it will be difficult to find a simpler or more effective method than that of lifting the balance plate as is done in the engine mentioned.



CYLINDERS OF TANDEM No. 1705 ON BALTIMORE & OHIO R. R.



DETAILS OF TANDEM No. 1705 ON BALTIMORE & OHIO R. R.

When a new locomotive can "run the rounds," as this has done with little or no attention, it is pretty good evidence that tandem compounds are thoroughly practical.

The latest use proposed for compressed air is to operate a platform that can be raised to the level of a baggage car floor, so that trunks and heavy baggage can be lowered without damage. It is a great scheme, but the only persons interested in its introduction are baggage owners, and they have no influence.

B. & O. Does Not Belong to the Pa.

At a hearing of a Senate Committee, President Loree, of the Baltimore & Ohio, insisted that a great mistake had been made in stating that the Pennsylvania Railroad Company owned the Baltimore and Ohio road. He said the Pennsylvania did not own that company and had on its directorate only four of the twelve directors. The Baltimore and Ohio Company had it within their power at any time to nullify the influence of these four directors in case they did not approve of their management. As it is now these four directors are being upheld in their ideas concerning the management of the road to such an extent that they do practically manage it. As long as their management is approved by the other eight directors they will be upheld, but he said that when these other eight directors cease to approve it they will be voted down. If they desired it, they could put out these four directors.

The managers of the St. Louis World's Fair are determined to encourage the development of the balloon-making interests which always have had headquarters in France. Two prizes, one for $100,000, the other for $50,000 are offered for a balloon race. The inducements to make money is likely to attract balloon makers, but it is almost certain to do no good. Giffard, the inventor of the injector, was very much interested in ballooning and the injector was invented in connection with high power designed to propel balloons. That was over fifty years ago, and no progress in balloon control or propulsion has been made since that day. For industrial purposes the balloon is worthless and it never will be improved; but a balloon race will make an attractive show.

The most important event during last month in the transportation world has been the securing by the Morgan capitalists, of control of the principal steamship lines in Europe. It is said that a syndicate with $150,000,000 capital has bought control of the leading steamboat interests of the world and that the managers of the merger will use their power to promote harmony in transportation rates. That probably means the kind of harmony that the man who pays will not enjoy.

The new shops of the Philadelphia Pneumatic Tool Co., at Twenty-first street and Allegheny avenue, are nearing completion, and the company expects to remove from its present location to the above address at once. The power plant is now installed and everything will be in readiness for the full operation of their new plant in the course of two weeks. They have ordered about $10,000 worth of new machine tools to be delivered to them early in June, and with these they shall soon be able to relieve their very much overcrowded condition and be able to make more prompt delivery than heretofore. About one hundred and fifty men will be required immediately to do the work which they are at present trying to do in their crowded quarters with ninety-five men. They have recently placed upon the market two new sizes of rotary drills and have perfected an improved riveting hammer which is being made in three sizes, having capacities varying from 1/4 to 1¼-inch rivets. They have received orders aggregating nearly two hundred tools, from one of the largest shipyards in the country, and this, together with a lot of railroad and other trade, makes an unprecedented rush of business.

The Central Railroad of New Jersey arrangement to run trains every hour between New York and Philadelphia is highly popular with a great mass of business men who find it necessary to make trips between these two stations.

The locomotives, cars and Pullman cars are the most modern, the roadbed is rock ballasted, and as only hard coal is used there is no smoke or cinders. Every train runs direct to Reading Terminal, Philadelphia, without change, and many of them cover the distance in 2 hours. The Reading route, by which the Philadelphia line is often known, is not only a short way to Philadelphia, but it is likewise the scenic route. This service goes into effect on May 18, but in no way does it impair the fast and elegant service of the Royal Blue Line, which will run independently of the Philadelphia line.

It is reported that the oil burning locomotives built for the Santa Fé at the Baldwin Locomotive Works a few months ago are not giving the good results anticipated. They have three corrugated furnaces each having an arrangement of burners. Those who criticise the performance say that the fuel supply is too much divided up in the three furnaces and that it is difficult to keep them from smoking. It is also said that when one furnace is smoking it is difficult telling which one is causing the trouble.

Eastern car builders are likely to have some dangerous rivals in the far West, where timber needed for the manufacture of many thousand of cars can be secured within easy reach. There is talk of various car building companies being formed in various parts of the Pacific slope, and a company, composed of Tacoma capitalists, has been organized for the purpose of building a large plant at Tacoma for the manufacture of railway freight cars, constructed of Washington fir. The capacity at first will be eight to ten cars a day, and 200 to 300 skilled workmen will be employed. The company will send part of its product to Japan.

Purdue University has now in process of erection a temporary building for the accommodation of its collection of historic locomotives. The building is 60 by 64 feet, and contains four tracks, three of which are already occupied by locomotives. The list includes the "James Tolman," an engine of English design, the B. & O. engine No. 173, known as a Hayes Ten-Wheel "Camel," and a 16 by 24-inch American type engine from the Chicago & Northwestern Railroad. We understand that the university very much desires to obtain an inside-connected engine which it can add to its collection.

Neilson, Reid & Co., locomotive builders, Glasgow, have adopted a novel method of encouraging their workmen to make full time. They intimated in January that every employé who loses not more than eighteen hours' time until the end of June will receive a present of a week's pay. In busy times a great many men get careless about losing two or three hours a week, and their absence from the shop frequently costs much more than their wages. The experiment of the Neilson people is said to promise success, for the most of the workmen are already getting in punctually in the morning.

Those who know Daniel S. Pedrick will not be surprised to learn that he is making numerous improvements in the shops of the Flanders Machine Works, Philadelphia, which he now controls. Old tools are being replaced by the latest and best, and there is a general air of betterment all around the place. This is reflected in their boring bars which are now more simple and better than ever. Mr. Pedrick speaks very highly of their 27 horse power Otto gas engine which is always ready for business and has proved very economical.

The telephone people come pretty close to "bearding the lion in his den" when they display their sign "Don't travel—telephone" over their booths in railroad stations.

Experienced machinists are being advertised for by the Baltimore & Ohio road. L. G. Haas, the new general superintendent of the Pittsburg division, has been instructed to secure as many machinists from Pittsburg as possible to be distributed to various points over the system. There is a great demand for expert workmen of this kind over the entire system, including the Baltimore & Ohio Southwestern. More machinists are needed at the Glenwood shops as the facilities for both light and heavy repair are being increased.

General Correspondence.

Repairs at the Mechanicsville Shop.

The accompanying picture shows the first large passenger engine to receive general repairs at new Boston & Maine shop, Mechanicville, N. Y. The men shown in picture are, commencing at the engine, Henry C. Manchester, asst. master mechanic; Wm. H. Nolan, engine dispatcher; M. J. Ahearn, fireman; E. W. Hines, engineer, and Henry A. Southworth, gen. foreman.

Engine 1133, shown in picture, has cylinders 19x26 inches, has 66-inch driving wheel centers, weighs 126,000 lbs., was built in 1900 at Schenectady Locomotive Works. This engine is in heavy, fast passenger service between Greenfield and Troy, on Fitchburg Division, of Boston & Maine R. R., and doing excellent work.

H. C. Manchester.
Mechanicsville, N. Y. Asst. M. M.

FIRST LOCOMOTIVE TO RECEIVE GENERAL REPAIRS AT MECHANICSVILLE SHOPS. BOSTON & MAINE R. R

American vs. English Locomotives.

Since taking your valuable paper I have been greatly interested in many of its articles, and the above has proved a very interesting subject to me; the arguments in favor of both have been very good. I would suggest to our American cousins that they build an engine to whatever design they think proper and send it to England to compete against the English engines on express passenger trains; we could then decide which is the best engine. Should the trial prove favorable to the Americans, it would be a decided benefit to their market.

As a road for the trials to take place on, I would like to see the London & Southwestern Railway chosen, from London to Exeter (172 miles); the American locomotives would then be able to show their pulling and fast running capability combined and would settle a point that has been discussed for some time. Of course I am well aware that this would incur a big expense, but as American engineers claim that they build a machine that pulls heavier loads at a greater speed I certainly think the money so expended would be laid out to great advantage.

E. J. Dunstan.
Shanghai & Woosung Railway, Woosung, China.

[It would probably be both interesting and instructive from en engineering point of view to have a thorough test of this kind made. We would not, however, confine it to fast passenger work nor to the other side of the Atlantic. A passenger and a freight locomotive of similar weight and power to our own might very well be tried on our roads in as fair a manner as possible. We should have outgrown the spread eagle days when everything of our own was perfect and all else defective and look at it from a purely engineering point of view.

Running time, coal, water and oil consumption, delays and repairs should all be carefully watched, and it is quite likely that all of us would be surprised in many particulars. If the tests were carried on as they should be, fairly and without prejudice, as far as human nature is able, they should add much to our general knowledge and be of value to both our English cousins and ourselves. We all want the best and should overlook even nationality in trying to find it.—Ed.]

Reporting Work.

I notice in May issue, an article from our friend G. W. Gravess, headed "Reported Work. Be Fair to the Engineer."

The latter part of this article strikes me as a little bit sarcastic and brings this thought, that if more harmony, followed by a little good feeling on both sides, and a motto that both are working for each other and a common good, viz: that of the company which employs them, that such a state of affairs would be eliminated.

Friend Gravess should remember that an engine standing in the round house with a poor working injector is not always surrounded by the same conditions as one running on the road. How often do we see the report, "injector don't work good." If the round house man is lucky enough to catch the engineer before he gets away, and has a conversation with him, he may learn that the greatest trouble exists when the water is low in the tank, or may flutter when curving on one side or the other, due to leaky feed pipes, bad tank hose or what-not.

Now, (with permission) some of the round house men do not ask the engineer to write the prescription, but to give fair play to both sides, the engineer should, in his report, give some of the symptoms of the ailment, thus affording the other man

some foundation on which to base his line of work.

To help one another is not a bad idea, and the mere report that the injector don't work good, is too vague, as the man in the shop is not with the injector from four to twelve and sixteen hours and has not the opportunity to view it under all conditions, both running and lying in a side track. If an engineer cannot or don't tell "where it hurts him most" how can he conscientiously expect the doctor to write a prescription to cure.

A great many things can be said detrimental to both sides, but that only encourages bad feeling and consequently poor work, so let us take the other view of it, and look upon each other as employees of a common employer, who has a right to expect that we will work to his good, and not let such trivial personalities affect our working, and cause us both trouble.

Hagerstown, Md. H. Van Horn.

More About Flat Spots.

I have just read articles in January number regarding flat spots on driving wheel tires. I thought I would give you one or two of Jim Skeever's object lessons of my own experience.

I did my firing on the same road which I have been running on for the past twenty-five years, and I used to think when I was throwing blocks of wood into the Baldwin we had, that if ever I got to be an engineer I would make great progress in running, by hooking up about two or three notches higher, as all those old timers in day time would look down when hooking up to see if all was right, and in night time you would see them feeling with bare hand to locate the same.

The last two years I fired was on a passenger train, and the engine ran over two years without putting flat spots in the tire, making thirty-five hundred miles per month. We used to have to sidetrack about every other station for some freight train, so that when we had a chance the engine was run as fast as she could run. A few years passed, and, after I was put on to pull a passenger train, I ran this same engine and the time was no faster than when I was doing honors on the left side. And with my modern ideas, working the lever two or three notches higher than the old timers, with wide open throttle, I succeeded in putting a place in the left main tire as flat as a country preacher's pocket book just before conference. This engine had never been changed, so I made up my mind that the firm that made the tires did not understand the science of tempering a tire without leaving a soft spot some place; but about all the engines I ran were the same and I took years to discover that the soft spots, instead of being in the tire, were under my own hat.

Now I do not believe that these flat spots come as a result of slipping, for if they did both main tires would be flattened opposite each other, for one wheel can not slip without the other going with it. But while all wheels flatten some, the engines could make fairly good mileage it it was not a fact that the left main wheel is so much worse than the rest. Now I would as soon attribute a poorly rendered solo to the fact that the performer was too lazy to keep the left side of his fiddle in as good tune as the right, on account of having the trouble of going over to the left side.

I noticed that about the time the roads began to figure on higher speed they also began to figure on heavier engines, but on account of existing difficulties, such as bridges and rails, the power was about as heavy as it was safe to run, so they overcame the difficulty by getting some new engines with an inch larger cylinder, without enlarging on the boiler, and I have noticed that I could run a 17-inch cylinder longer on some trains than I could an 18-inch cylinder with same sized boiler. I believe the reason to be that we have to have the larger cylinder nozzled down more in order to make steam, and on hills where you could drop the smaller to use more steam, with the larger you can't for if you do you will not hold up in steam, consequently, using the larger engine hooked up more, shows up on the tire. And I believe the larger engines you get with their correspondingly larger pistons, cross heads and rods, necessitating more counter balance, makes tires shorter lived.

I used to run a sixteen-inch cylinder on a freight. This engine would run steady as a clock up to about 40 miles per hour. Any faster would set her to jerking so bad that the fuel would all start for the deck of the engine. This engine was taken into the shop and additional counter balance, in shape of large iron blocks, put in between counter balance and hub. I afterward ran this engine in passenger service. She could run 65 miles an hour and rode steady as a clock. Now I think this is prima facie evidence that the higher the speed the more counter balance it takes, and I would like to be present when some engineer got in after running an engine over a division on one of our schedules to-day: to hear him give his experience (if he was able), for I think he would have the appearance of an over-enthusiastic standard bearer for a football team after an attempt to pass through the opposing lines—slightly out of breath.

A few months ago I went to the convention of engineers, held at Milwaukee. On my return I got up to ride with one of my neighbors, who was running a large modern standard engine. When we started out of town it did not take long to discover that the engine had a very flat tire on the side I was riding on. I asked the fireman how long the engine had been out of the shop. He said about five months. When we got to going, the engineer began to hook back the lever, and when he got in where he let it stay, it was in about the position I would have thought it should be if I was going in an opposite direction. The engine was hitching around. I thought she acted as though she was trying to get crosswise of the track, and it put me in mind of driving a hobbled horse in a pacing race, who had inclinations of his own to go at some other gait.

This engine was run by three different men, and if they all used the same medicine, it was no wonder she was flat. There is always some man among others who is a coal saving fiend and will work an engine anywhere to save a few pounds of coal, and will do most anything, even to laying out his neighbor a little, if necessary, at meeting point. While I believe in working for the interest of the company, I think there is a happy medium to most everything. If superintendents of motive power would take my advice, they would plug some of the center notches on the quadrant, so that some of these great expansionists would have to sit and hold the reverse lever or put it where, in a master mechanic's opinion, it ought to be. Then if there was any complaint from headquarters about using a little too much coal, I would fix every fire box while I had the engine in the shop, so that it would be in condition to carry a full sized arch.

Minneapolis, Minn. R. T. Stafford.

[We had intended stopping this discussion on flat driving wheel tires, but we publish this letter because we think the writer makes points that are worth noting about cutting off very short. We do not think the practice even saves fuel. —Ed.]

Flat Tires on Egyptian Roads.

I have read with very great interest an article in your January number on flat spots in driving tires. Without stopping to enter into a discussion, allow me to push on to the practical side of the question.

I have been driving an American locomotive for a year and during that time the driving tires have developed flats twice. Once after a month's work, and the second time after three month's work. When first the engine was given me, I found she did her work well with the lever just one notch from the center, and with just sufficient steam to work her to time. As remarked above, the engine had to have her wheels turned up after three months, though she was all right in other respects. After the engine came out of the repair shops, thinking to remedy the evil of flat spots to some extent, at least, I decided to work her

with the lever further out and less steam if possible, but I found on the contrary that more steam was necessary; the engine seemed to be struggling along. I very naturally attributed the cause to the trucks (cars) being more loaded than formerly, and therefore did not attempt to pull the lever up. What was by surprise to find that the flats developed worse after three months' work than after the first three months. Latterly, we being allowed a little more time to do the run, I pulled the lever up to one notch from the center, and lo and behold, the engine seemed to work all at once as free as at first, and I had to ease off the throttle. As this struck me as very strange, I put the lever out again, and again the engine began to lag. I tried this three or four times, always with the same result.

After a perusal of the above, what deductions can you arrive at but that the fault lies in the throw of the valve?

In trying to locate this fault, I noticed that the rocker arm, having a circular motion, imparted at the same time an up and down motion to the valve spindle, this latter motion being also, to some extent, detrimental to spindle packing and weak rings. Now by having an elongated eye in top of the rocker arm and the necessary guide, this up and down motion is obviated. The valve spindle-pin, working either back or forward in the eye, allows of a little more throw to the valve and thereby regaining the lost motion.

I am not acquainted with many American types of engines, but from a glance at many of the illustrations in your interesting journal, I see they are nearly all designed alike in respect to the rocker arm.

The British practice always having the elongated eye or a die block for the rocker arm, and it is not so common in British-built engines to develop flat spots and driving tires. In fact, after twelve years' experience this is the first time I have ever come across it.

Therefore, in my humble opinion, by having the elongated eye in the top of the rocker arm and thereby allowing the valve to have its full throw, the driving tires will not, I am sure, develop flat so soon as eight months. I do not profess to say that this alone is the cause of the evil, but that it will to some extent remedy it.

J. WHITE,
Engine Driver.

Soudan Government Railway, Soudan.

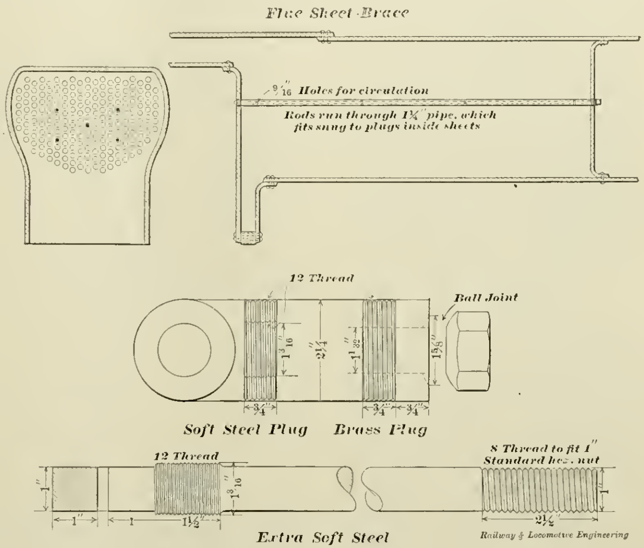
Says a good authority on locomotive practice: "Your correspondent fails to say at what speed engine is run. What point of cut-off the first or any other notch will give, that has worked the engine. One has little to base an opinion upon. So far as the vibration of valve rod at rocker connection having anything to do with the flat spots is beyond conception. He does not say what place on tires are flattened or whether they occur in same place each time. There are many things that cause tires to have flat spots, such as soft places in them, engines out of balance, running with too short cut off, valves not properly set, working engine heavily while sand is being used, etc., none of which can be cured by carrying back end of valve rod in straight line." D.

Those Old Locomotives.

If your interesting correspondent, Mr. H. C. Frazer, thinks that his notes on and names of old "John Brandt engines are not interesting reading, he is counting without his host." I knew every one in the list. But I must ask Henry to stand up and be corrected. The legend on the hub plates of the Keystone, Conowingo, Utah, Minnesota, Clearfield, Clinton, Shanghai, John Gilpin, Yorick and Corporal Trimm, did read N. J. L. & M. Co., Paterson, N. J., John Brandt, Supt. Yes, they were all Brandt engines, but not all built at Lancaster, Pa. And they were all smart, steady running engines, and one of the factors contributing towards their steadiness was, well just look at the stroke and diameter of cylinders. The old man's head was level on those two points.

The Keystone and Conowingo were the first engines with wagon top boilers and link motion on the State road. The wagon top was covered with brass, and with two brass covered domes, and engine and tender handsomely painted, they did look fine. The steam chest was cast iron finished, nuts and all, cylinder heads turned and bronzed. The cylinders were naked as the day they came out of the foundry, except a coat of black paint. Why the importance of lagging the cylinders and covering the steam chests was overlooked, is not known.

The Shanghai and John Gilpin were the first to come to the road with cylinders lagged and cased flush. You will notice the political drift of some of the names, Buchanan, Breckenridge; and Wheatland was the home of Jimmy Buck. In reading over the rest of the names it is not hard to name the class of books in the library of the Gen. Supt., Mr. Joseph B. Baker. Toney Wells spoke of his son as "my son Samivel" (not Samuel, as printed).



METHOD OF PREVENTING LEAKY FLUES—SEE NEXT PAGE.

Mr. Frazer quotes some of the Norris engines built for the Western Pacific. The writer had the honor of running one of them, the Sonoma, letter H, not numbered at that time, afterward, 173; her mate, the Merced, 172, was the first engine to get an extension front end, in Sacramento shops, put on by A. J. Stevens. There was another lot of the Norris engines that came to the C. P., but were built for a five-foot gage. When then came here (around the Horn) the driving tires were set in and engine and tender trucks changed to standard gage. One of them, the "Mojave," old number 37, is still in service at Fresno, on the S. P.; her number at present is, I think, 1108.

There were locomotives built in Lancaster, Pa., a long time before the establishment of the Brandt works.

W. DE SANO.

Kern, Cal.

Prevent Leaky Flues.

Referring to your article on "Leaky Boilers," page 211, May number: For several years past we have had considerable trouble with leaky flues (especially on engines carrying 180 pounds steam pressure), and it was not unusual to put an engine in two or three times a week for flue work. On February 12 we put an engine in, and removing five flues, applied five one-inch braces extending from flue sheet to flue sheet. In order to give additional stiffness to sheets, and to prevent rods from sagging, a 1¼-inch pipe was put over the rod, which fit up snug against the plugs on inside of sheets. The firebox end was hammered over, and a hex. nut (making a ball joint) put on the front end.

Since applying the above we have done flue work on this engine but twice, and then but a few flues each time.

Later we equipped three more engines in the same manner, whose performance in this regard has proven equally as satisfactory as the first.

I take pleasure in sending you herewith blue print of braces, trusting that it may be a benefit to some other fellow who has trouble along the same line.

B. B. Cargo,
Lorain, O. Master Mechanic.

What Ailed this Engine.

An engine was turned in by a road man who reported a broken valve yoke. The engine was examined and the valve and yoke found in good condition. The engine would move ahead all right and make the exhaust all right, but when put in the back motion with the right side on center it would stand still with the throttle wide open and blow straight through the valve and out the stack. H. W. O'Neil.

[Here's a chance for several hard thinks. —Ed.]

The Grand Trunk Railway has recently contracted with the Safety Car Heating & Lighting Company for the equipping of fifty additional cars on their line with the Pintsch system of lighting. The Pintsch Gas Works at Moncton, N. B., which has been in the course of construction for the past two months, is now completed, and gas is being made there for use in the cars of the Intercolonial Railway.

That the locomotive works of this city are very busy is shown by the fact that ten engines were turned out and shipped this week, five each from the Rogers and Cooke shops. This perhaps more than equals the "palmy" days that old locomotive men like to talk about, as the engines of to-day weigh double and often three times as much as those turned out 25 years ago.

The New Packing Inspector.

BY R. E. MARKS.

I dropped into the shops of the Blimtown road the other day and inquired for my friend Jack Johnson. "Room No. 3, second floor front," said the watchman, and I began to think I'd struck a trunk line instead of the little jerkwater where I used to run. However, I followed directions, and on the door of room 3 (never had but two offices before) I found "Packing Inspector," and through the partly open door I saw Jack.

"Come in, Marks, old boy—where have you been all winter? I have lots to tell you."

"What's the new game, Jack—packing inspector is new on me."

"Well, it's just this, Marks—last fall we began having engineers report 'packing blowing' every trip. Sometimes it was valve rods, sometimes piston rods, more often both. You know I used to make the packing rings in the shop, and it hadn't got far into November before I was working nights and Sundays making rings and putting 'em in. We just cast 'em in an iron mold, you remember; always thought it was a great money-saver, too, that mold.

"I got knocked out last December—grip the doc. called it, and then the old man was up against it for fair. Wanted to know how he could get along, and I suggested he order a lot of rings from the packing company till I got round again.

"That came pretty nearly losing me the job, for they lasted a darn sight better than mine ever did. So I wrote to them to find out the whys and wherefores of the case, sending 'em a set of rings I'd just made.

"About the third day a young fellow came around asking for Jack Johnson, and when I pleaded guilty of owning that name he said he'd just come down to see me make rings. Kinder flustered me, of course, but I mixed up some metal, 9 parts tin, 1 part copper and 1 of antimony.

"Pretty fair mixture says he, but not as good as ours, and cost just as much. Better try 83⅓ parts lead, 8⅓ parts tin and 8⅓ antimony, then cast in a mold that will allow finishing all over. Then he showed me how to make a spring chuck for holding the rings and a forming tool for trimming them, and told me that was why their rings outlasted mine.

"I supposed their mixture was a secret and the turning was just to give 'em an excuse for charging a round price, but he told me just how they did it and that they liked to make the rings because they fitted and wore better, but that I could do as well if I tried. Trouble was I'd been putting in chunks of metal that didn't fit either the rod or the packing chamber, and then expected it to hold steam.

"Well, we got things to running along fairly well, the packing troubles we cured easier on account of our rods being ground round and true on that Norton machine, when those 500 class of piston valve engines began to arrive. I don't know who ordered 'em, but whoever did wanted to be in style, I suppose.

"It wasn't long before the old man came to me again. 'What in thunder is the matter with your packing rings, now, Johnson? Thought you had cured that trouble with your new packing mixture, and turned rings, but look at these.' And he handed over a fistful of engineers' reports. 'Every blamed one of 'em is packing blowing—now what's to be done?'

"I was stumped—knew the rings were just the same as before, and I couldn't see why this epidemic should strike 'em all at once.

"Better take a trip on the 513, Jack," he said—"she fogs up like snow storm around the front end. Perhaps you can get a pointer or two before you come back. That's a way he has, and a mighty good one, too, I think. Lets you see things and ferret 'em out.

" 'Twas just as he said—the 513 looked like a fog bank as soon as she started. Steam coming out in every direction. But I also noticed there was as much in front as behind the cylinder, and I called the engineer's attention to it. Then I asked him if he'd had any such trouble on the 400 class, with the balanced valves. Said they were all right. They had extended piston rods, too.

"Coming back I waited for number seven, with the 408 hauling her. Nothing wrong with her packing, but there certainly was with the 513, as well as the other blows. Why was it?

"In the first place I concluded that the rod packing was being blamed promiscuously for all blows—but it had a few of its own, too. These I had remedied largely by following the packing company's advice, and we'd saved a good many dollars by doing so—lengthened the life of rings from one day, in some cases, to months—but here was another problem.

"So I called on the old man that night and told him that all the blows were on the new engines and not many of them were really rod packing troubles. Wanted to know why, of course. Then I gave him my theory—thought it out on the way home.

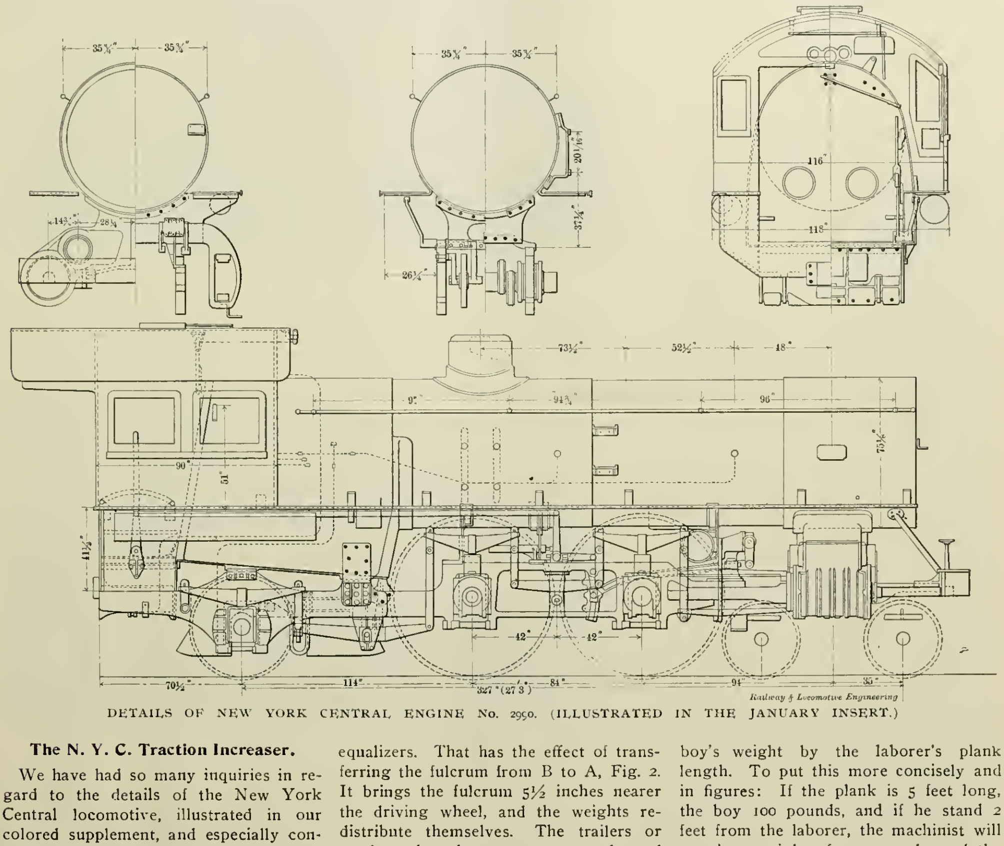
"There wasn't any question but that all the cylinder and valve chest heads leaked—but why? Just one reason and one word tells the story. WATER. Bound to work a little water sometimes. No balance plate to lift, something has to give. Water don't compress for a cent, bolts and studs will stretch. Result, leaky heads. This affects packings, too—sudden shock forces water out around rod and every place possible, and steam doesn't miss a chance to follow a mighty small leak after it's once started.

"Old man said I was a crank, but when

he found every blamed piston valve engine leaked and the others didn't—he came round on my side of the fence. Now he thinks Jack Johnson does have a stray idea once in a while, and he caged me up in here so they wouldn't get away.

"But our rod packing troubles have quieted down on the regular engines, and when they get over the piston valve fever we expect our troubles will be over. The packing is getting the attention it deserves, and the expense account is cut in half.

"And say, Marks—I've done something no one else ever did—talked so fast you haven't had a chance to get in a lick sideways, and—there comes one of the fog-banks now, and it isn't the packing, either."



DETAILS OF NEW YORK CENTRAL ENGINE No. 2990. (ILLUSTRATED IN THE JANUARY INSERT.)

The N. Y. C. Traction Increaser.

We have had so many inquiries in regard to the details of the New York Central locomotive, illustrated in our colored supplement, and especially concerning the traction increase, that we present the following by George S. Hodgins:

The device known as the traction increaser, and used on the Central-Atlantic type of engines on the New York Central Railroad, is a most interesting and ingenious piece of mechanism. A pair of air cylinders are bolted to suitable plates secured to the frames (they are placed just back of the rear drivers), and they operate two levers of the second class, with push pieces which bear upon the equalizers which lie between the rear drivers, and the small carrying wheels. These push pieces press upon the equalizers just in front of the ordinary pivot. This normal or ordinary fulcrum is at the oblong hole shown in the illustrations. When the equalizer does its duty, in the usual manner, without the traction increaser, there are 94,800 pounds on the drivers and 38,600 pounds on the carrying wheels.

When it is desired to increase the tractive force of the engine, an air valve, operated from the cab, is opened, the two vertical cylinders fill with air, and the push pieces are forced down on the equalizers. That has the effect of transferring the fulcrum from B to A, Fig. 2. It brings the fulcrum 5½ inches nearer the driving wheel, and the weights redistribute themselves. The trailers or carriers then have 34,200 pounds and the drivers 104,800 pounds. There is not much observable motion at the fulcrum B, but weight is very effectually shifted.

If anyone thinks it worth while to prove the effects produced by the long and the short arm of a lever, like this equalizer, he can do so in many ways. One way, which may be tried in any shop at the noon hour is to have a machinist and a laborer stand facing each other, holding with arms at full length, a plank between them. Suppose that a boy stands upon the center of the plank; and we have a rough approximation to the equalizer. The boy represents the fulcrum, and his weight presses downward; the man's arms, like the spring hangers, are holding up. Suppose now the boy walks a step or two toward the laborer, that worthy will find his load has increased, while the machinist will bear less weight. The way to find the actual weight each will carry, is of course, knowing the boy's weight, to multiply his weight by the length of the machinist's end of the plank, and that gives the laborer's load. To find what the machinist is carrying, multiply the boy's weight by the laborer's plank length. To put this more concisely and in figures: If the plank is 5 feet long, the boy 100 pounds, and if he stand 2 feet from the laborer, the machinist will sustain a weight of 200 pounds, and the laborer will hold up 300 pounds.

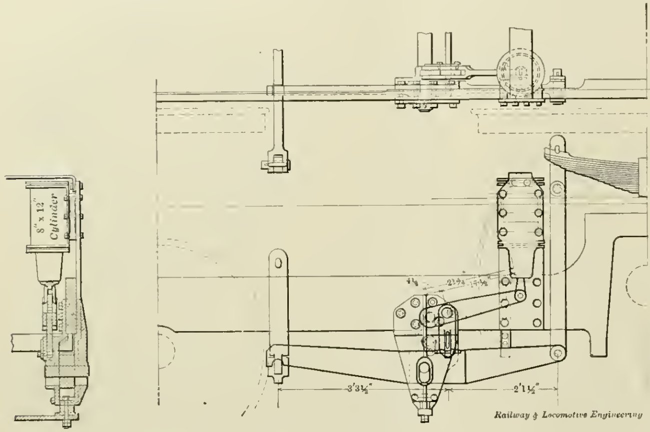
The traction increaser simply takes weight off the carrying wheels by moving the fulcrum, and transfers it to the drivers, just as the boy puts more weight on the laborer by walking toward him. There is nothing mysterious about it all, although some of the non-technical papers seemed to imply that there was.

Shifting weight from the carrying wheels and putting it on the drivers, is not the whole work of the traction increaser. At the same time it does this, it takes some weight off the front truck, and adds to the drivers. Normally there are 42,600 pounds on the engine truck. When the traction increaser is used, the truck weight is reduced to 37,000 pounds. At first sight, it appears as if the engine truck should really carry more weight than usual, when the traction increaser is used, and the interesting point is to know that it does not, and to see why it actually carries less. An experiment can be made with a two-foot rule, which may throw some light on the how and why of the matter.

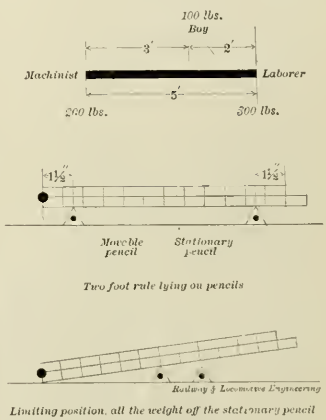
A seeker after truth, using perhaps two of Mr. Joseph Dixon's three-sided lead pencils as improvised knife edges, may lay the doubled up rule upon them, placing the pencils 1½ inches from each end. Now keeping one of them stationary, he may move the other pencil toward the center of the rule. He is now shortening the base of support. The overhang at the stationary pencil's end is 1½ inches, but the overhang at the other end increases. If the motion of the moveable pencil be continued, the weight on the stationary pencil will steadily decrease, and eventually there will come a time when the rule will tip up off the stationary pencil, and it will then not carry any weight at all. This is what mathematicians would probably call the "limiting position." This limiting position serves to show by the tilt of the rule what has really been going on while the moveable pencil slid inward. With increased overhang at the back of the rule, weight was reduced on the stationary pencil, as the base of support was shortened.

Now applying this method of reasoning to the engine, we find that the traction increaser when put in operation, moved the equalizing fulcrum forward, and increased the overhang at the back. More weight then came upon the drivers, as was proved by the machinist and laborer experiment. The increased back overhang had a tendency to tilt the engine backward and so reduced the load on the truck. No appreciable tilting takes place, because the carrying wheel springs do not permit it, they are not fully relieved of this tension. The limiting position for the engine, if one may so say, would be to take out the carrying wheels altogether, and ascertain the weight then carried by the engine truck. It would certainly be considerably below the normal figure.

The engine is not supported upon knife edges, as the rule was supposed to be. It is held in place upon a system of springs and equalizers which is intended to provide for the very adjustment which takes place. The engine responds at once to the altered conditions and readjusts the load on all the axles when the traction increaser comes into play. This cleverly designed piece of mechanism has the effect of quickly concentrating weight upon the drivers when it is so desired, and of taking it from carrier wheels and truck. When in operation, the traction increaser adds about 10,000 pounds to the weight on the drivers, and reduces that on the carrying wheels by 4,400 pounds, as well as relieving the engine truck of 5,600 pounds, at the same time.



DETAILS OF TRACTION INCREASE USED ON ENGINE No. 2990 OF THE NEW YORK CENTRAL.



HOW THE TRACTION INCREASES WORK.

Scalper and Regular Close Together.

The man in the brown ulster had haggled with the scalper for ten minutes over the price of a ticket to Minneapolis.

"There's no use talking," said the scalper, "I can't sell you a first class ticket to that point for less than $8 to-day."

"I can go to the regular offices right around the corner," contended the other, "and buy one for the same figure."

"You needn't go around the corner," responded the scalper, whose patience was exhausted. "You can go right through our back door. It opens into the regular offices."

Steamers Burning Oil Fuel.

The immense supply of liquid combustible flowing from the Texas oil wells has directed the attention of certain ship owners to the saving in cost of fuel they could make by using oil in their steamboat furnaces instead of coal.

Last month a trial voyage was made with the United Fruit Company's steamer "Breakwater" burning oil and she was the first ocean vessel to be equipped with oil burners at any Southern port. The trial was a complete success. Using only six of her twelve burners, a steam pressure of 104 pounds, the regular working pressure, was easily maintained. It took only four hours to get steam up for the voyage, a saving in time of twenty hours over the use of coal.

Manager Ellis, of the United Fruit Company, stated that the use of oil meant the saving of fully 50 per cent. in fuel bills. "The cost of coal on one of the Breakwater's round trips to Central America," he said, "has averaged about $1,100. The cost of oil for a round trip will not run over $550. In addition, the service of three firemen and three coal passers are dispensed with. Eventually every vessel belonging to the United Fruit Company's fleet will burn oil, and we will use oil exclusively in Central America on our locomotives and for our stationary engines. We burn annually 500,000 tons of coal in Central America."

A. L. Roy, manager of the Mexican-American Steamship Company, was one of the party aboard the Breakwater on her trial trip. He said that the vessels of his company, too, would be immediately equipped for burning oil.

The cost of installing the oil burner on the Breakwater was something less than $4,000. The principal cost was the building of the two 750-barrel tanks. About 800 barrels of oil are consumed in making a round trip.

A Novel Staybolt Threading Machine.

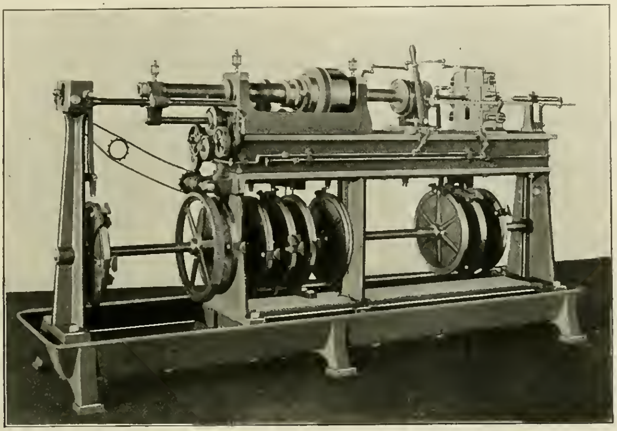
These machines have a capacity up to 1¼-inch in diameter and 12 inches long, and will turn out about 150 6-inch bolts in 10 hours, including all regrinding and setting of cutting tools.

The form of reduction, midway between the two threaded ends of the bolts, can be varied to suit different requirements. The main feature of the machine, aside from the automatic feature, is the accuracy with which the lead in the thread is maintained, it not exceeding more than 3 to 5-10,000 error in 12 inches, after the machines had been in service about two years.

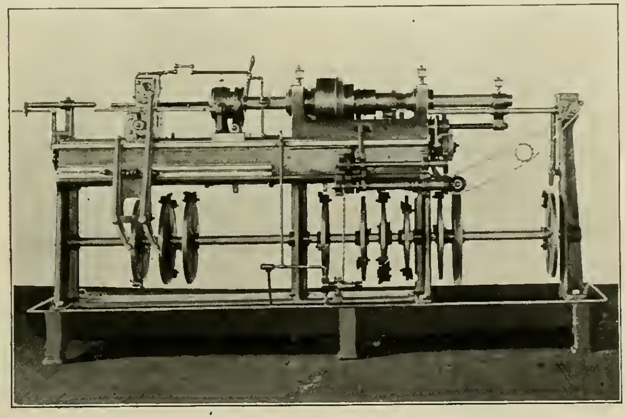
This form of bolt can probably be produced in larger quantities in a given time by other known methods, but this method has a distinction of reducing the torsional strain on the internal fibers of the bar to a minimum.

We also find that more of these bolts are in perfect repose after being screwed in position in the boiler, than is the case with other forms of bolts which we have used at this point, for the reason that an excessive amount of leverage cannot be applied when screwing the bolt in, in case the thread is crossed when bolt entered the inner sheet, which we find was very frequently the case with other types of bolts.

Eight of these machines have been completed at the Juniata shops and others are now in course of construction. They are the invention of Mr. A. W. Epright, Scale Inspector of the Pennsylvania R. R. at Altoona, Pa.



FRONT OF EPRIGHT'S AUTOMATIC STAYBOLT CUTTER.



BACK OF EPRIGHT'S AUTOMATIC STAYBOLT CUTTER.

Fast Time on the Pennsylvania.

One day last month the St. Louis express ran from Harrisburg to Morrisville, N. J., 126 miles, in 125 minutes. These long runs, made without shutting off steam, are the severest test of the capacity of a locomotive.

The schedule time of the St. Louis express between Harrisburg and Morrisville is three hours and ten minutes. When Harrisburg was reached, the train, which is known as No. 16, was 58 minutes late. It was composed of six cars—four Pullmans, one day coach and a combination car.

At Harrisburg the engine that had pulled the train from Altoona was taken off, and engine No. 1968, in charge of Engineer Fred Miller, put on, while Conductor George Tullock took charge of the train. They pulled out of Harrisburg at 4.37, and at 6.42 arrived in Morrisville, having made the run of 126 miles in 125 minutes.

The chronic controversy about the relative merits of British and American locomotives has again broken out owing to a report concerning locomotives for the Egyptian Railway. Lord Cromer has been foolish enough to make a somewhat sweeping condemnation of American locomotives and American methods and naturally the friends of the American locomotive came forward in its defense. Lord Cromer has the reputation of being a very astute politician, but when he assailed American locomotives he opened his mouth to put his foot in it. The fact is American locomotives and American machinery do not need any defenders. They are pushing all other rivals aside in every country of the world where they have a fair field and no favor, and as long as that continues to be the condition of affairs our people need not worry about the criticism of their enemies.

The Crosby Gage & Valve Co., Boston, are very much gratified at the reception being given their spring seat globe and angle valves.

On the Burlington Railroad system of 8,000 miles, over 385,000 wheels are in service under the various passenger, freight and way cars, locomotives and other rolling stock. An average of 40,000 wheels are purchased each year and they are very carefully inspected, as they are bought with a guarantee. According to the stipulation, each is warranted to last six years or cover seventy-five thousand miles. All the wheels are numbered and a careful record kept. When they fail to do the work they are returned to the manufacturer, who is compelled to make the loss good.

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The average circulation of RAILWAY AND LOCOMOTIVE ENGINEERING for the first half of 1902 has been 21,750 copies, and two numbers were out of print inside of ten days after issue. This for the information of those who have imagined that the subscription list had decreased this year.

Instruction of Car Inspectors and Others.

One of the subjects under investigation by a committee of the Master Car Builders' Association is headed "Examining Car Inspectors." The principal work of this committee is to devise some means of increasing the efficiency of car inspectors by imparting training concerning rules of interchange of cars. There are chronic complaints that many car inspectors are densely ignorant concerning the details of interchange rules, and that they make no attempt to study the code that is annually provided for their guidance after the Master Car Builders have made all the changes that the different tastes of the association consider necessary.

In failing to study the rules of interchange of cars the car inspectors are not different from other railroad employees who are supplied with rules which they are supposed to make themselves familiar with. Providing each man with a copy of the rules is done in a prefunctory fashion, and the men receive the book in the spirit it is given. They lay it aside and forget that they had ever received it. The Master Car Builders' Association intend to devise means for making the car inspectors study the rules of interchange and make themselves sufficiently familiar with the rules to do their work as the rules direct. which is a very commendable movement. but it is one which ought to be carried out by the officials of the different railroads who are responsible for the car inspector's work being done as the rules of interchange of cars demand. In this respect car inspectors, trainmen, signalmen and others who are required to perform duties laid down in established rules ought to be treated alike. They ought to be examined periodically concerning their understanding of rules, for it is notorious that nearly all rules are susceptible of different interpretation. If this practice were adopted, a vast reduction would be made in the disputes that are constantly arising in the interchange of cars, and fewer accidents would happen through trainmen and others misunderstanding train rules and train orders.

The management of the Queen & Crescent system have established a system of instructing employees concerning their duties that deserves to be followed on all railroads. The men in charge do not assume that because a trainman, telegraph operator or other person required to perform responsible duties has received a book or rules defining his duties the responsibility of the management ends there. They make it their business to see that the men have made themselves familiar with the rules and understand them. This calls for considerable instruction and examination, which are given in classes established for the purpose. No man can begin work on the road as a trainman, operator or in other capacity where a knowledge of signals, air brakes and train rules is necessary without attending one of these classes and obtaining a certificate of efficiency. When men are attending the instruction classes some of them frequently understand rules about signals, brakes, etc., differently, and it leads to discussions which are edifying and instructive to all the people present. The effect of this training is that the men who have to carry out movements regulated by rules do not have the knowledge of what ought to be done vaguely in their minds, but have it as positive inspiration which leads to the doing of the right thing, no matter what cause for excitement may surround the man. A trained soldier is braver than a raw recruit, even if he may not have been under fire before, and the engineman or operator rigidly schooled to perform certain actions will perform them no matter what sudden emergencies may arise to unsettle his nerves. The training which keeps men's minds keyed up to perform difficult duties properly at all times is worth much to a railroad company. The training does not end with the ability to pass one examination. The men concerned are required to attend the instruction classes a certain number of times annually and an air brake certificate of efficiency must be obtained every year by all conductors, engineers, firemen, porters, brakemen, car inspectors, repairers, baggagemen and all shopmen who have to handle air brake equipment. We incline to think that the car inspectors belonging to the Queen & Crescent will not require any attention from the M. C. B. committee.

It is not easy to estimate the money value of highly instructed employees as compared with those who do their work without the regulation of knowledge, and on that account it is difficult to convince railroad companies that it would pay them to have their men instructed concerning their duties so that the work might be done by exact rule instead of by haphazard. There is no question that the Queen & Crescent road has saved many thousands of dollars under the working of the knowledge system through the avoidance of train wrecks and other accidents, and many people are alive to-day and enjoying the pursuit of happiness who would have been in their graves under the prevailing system of railroad management. We understand that Mr. Samuel Spencer, president of the Queen & Crescent, takes a keen interest in what we might call the "knowledge plan" and that humanitarian reasons may induce him to recommend its extension to other lines. Many of the men who have to go through the routine of instruction are reported to prefer the old free and easy going, know nothing practices, but the spirit of railroad progress favors the new methods and they are bound to become popular in the end.

What is the Best Size of Smoke Box?

The size of smoke box that is best calculated to produce a free steaming locomotive is still a matter of controversy among those who devote any attention to the subject. There has been plenty of public discussion about the merits of large and small smoke boxes, but very few of the men in charge of locomotives have exerted any intelligent effort to find out what volume of smoke box gave the best results in proportion to the quantity of heat units generated in the furnace. When locomotives were first brought into use the designers considered that all the volume of smoke box necessary was the providing of sufficient space to permit the gases from the fire to pass from the tubes into the smoke stack without restriction. At first the space allowed was remarkably small, little more than an extension of the cross section of the flues, but the volume was gradually increased until there was about three cubic feet of cubical content in the smoke box for every square foot of grate area. This proportion was no doubt discovered by a ten-

tative process, the cut and try again method by which nearly all proportions of locomotives were established.

D. Kinnear Clark, in his treatise on railway machinery, which has been the guide and counselor of locomotive designers for fifty years, recommends three cubic feet of smoke box capacity for every foot of grate area. That came very close to American practice until the fashion of using extended smoke boxes came into vogue which entirely changed the proportions that had previously found favor. The old practice in establishing the size of smoke box to suit a certain size of engine was settled on the foundation of experience, and was not likely to be far wrong; the practice of using extended smoke boxes was introduced to follow a fashion, just as it is the fashion now to use piston valves, and there was much probability of proportions being adopted that would not produce a good steaming engine, or at least not the best steaming engine that could be made with the size of boiler and grate area provided.

There is still conflict of opinion among locomotive men concerning the merits and the shortcomings of the extension smoke box. When it was first introduced, it received undeserved credit as a promoter of free steaming which rightly belonged to the open smoke stack. The plate diaphragm, employed in connection with the extended smoke box and open stack, offered much less obstruction to draft than the cone and netting in the diamond stack, which, with the result that it produced a better steaming engine, prejudiced many master mechanics and engineers in its favor, for every change is popular that will improve the steaming properties of a locomotive.

When the extended smoke box was first brought into use, the intention was to make it a reservoir for sparks, and on that account it was made very large; of much greater capacity than was considered adapted to the easy regulation of draft appliances. As the blast of the exhaust steam has to create a partial vacuum in the smoke box, a large smoke box will take a stronger blast than a small one to produce the same effect upon the fire, but the action created upon a small smoke box may be too violent for easy management of the fire. There is a mean size of smoke box volume somewhere which is best adapted to producing a free steaming locomotive.

We frequently hear the remark made that an engine does not steam so well after the smoke box begins to fill up as it did when the space was empty. That proves that the larger space is more conducive to free steaming than the smaller space, or that there is a size between the entirely empty and the filled up space that produces the best results. The men in charge ought to find out which is the most satisfactory mean and design their smoke boxes accordingly. If the small space or the large space was the normal size, the draft appliances would be adjusted to make the engine steam as freely as possible with that condition. The investigator trying to find out what proportions of draft appliances will make the most efficient locomotive, ought to have no great difficulty in demonstrating what size of smoke box is most conducive to free steaming.

The Battle of Saratoga.

The above caption does not relate to the battles fought annually for several years in the conventions of the Master Car Builders and of the Master Mechanics' Associations, but to a battle fought during the War of Independence, which was the most important in that great struggle and is rated in history as one of fifteen decisive battles of the world. In writing about this famous battle we deviate a little from our recognized field; but we do it because the people who attend the Saratoga conventions seldom display any interest in seeing a battle field which is of greater importance to patriotic Americans than the field of Waterloo is to the nations whose safety was assured by the defeat of Napoleon. It is a melancholy fact that many of the people who attend the Saratoga conventions never heard of the battle of Saratoga.

The Stamp Act which imposed taxes upon the colonists without representation was passed by the British Parliament in 1765. A hurricane of rage passed over the American colonies. Meetings and conventions were held all over the colonies and violent resolutions were passed denouncing the Stamp Act and its authors. The opposition was so furious that the Stamp Act was repealed the following year; but in 1767 a still more obnoxious act was passed which proposed putting duty upon certain imports entering America. That brought out a more violent storm than the Stamp Act, and culminated, so far as duty on imports were concerned, in the Boston Tea Party. In due time the British forces and the rebellious colonists were in open conflict. Massachusetts took the lead in rebellion and there the battles of Lexington and Bunker Hill proved that the descendants of the Puritans were ready to fight for justice. The New England colonists were the principal hot beds of rebellion and their sons did much to keep the flames of revolt alive in the other colonies. Bunker Hill was fought in 1775 and the following year the Declaration of Independence was adopted. There had been various battles between the Continental army and the British troops in these two years, but nothing of great importance had been done by the rebellious colonists to invite the aid of Britain's enemies. All the colonies were in rebellion but most of the fighting was done by proclamations and resolutions. About the beginning of 1777 the British military authorities concluded that the best plan for ending the war was to insulate what is now the New England States from the other colonies, and for this purpose General Burgoyne led a powerful army from Canada through the lakes for the purpose of reducing all the strongholds in his route. He was to meet a British army at Albany sent up the Hudson destroying the obstacles to royal rule wherever found. The two victorious armies would make short work of the rebels still in the field.

Burgoyne carried out his program until he reached Bemis Heights on the right bank of the Hudson River about seven miles from Saratoga Springs. There he found a strong army of the colonists ready to dispute his progress in a camp planned by the Polish patriot Kosciusko. On October 7 a fierce battle was fought and Burgoyne's army was so shattered that he retreated next day, but was compelled to capitulate a few days afterwards at Schuylersville, a few miles from the battle field.

Numerous monuments have been erected to identify the different events of the battles and the plan of the defenders can be easily understood by a short visit to the place.

The entertainment committees of the various railroad mechanical conventions held at Saratoga have had so much money to spend in different years that they had difficulty in disposing of it, yet there has never been an excursion arranged to permit visitors to see the scene of the greatest battle fought by the patriots of the Revolution.

High Speeds and Wind Resistance.

The startling high speed records of one hundred and one hundred and twelve miles per hour that have been purported to have been made some years ago with light standard engines have always been regarded with slight distrust. With the known capacity and performance of the swift, powerful express locomotives of to-day, and more accurate and perfected recording apparatus now obtainable, these purported high speeds seem more suspicious than ever.

When we recollect that 112 miles per hour is almost twice as fast as 60, and that a train running at the former speed is kicking back distance at the rate of 165 feet each second, we are inclined to become credulous and to regard these high speed statements as extravagant and loosely made. At such abnormally high speeds, the error of a fraction of a second in snapping a stop watch will sometimes make a difference of five to twelve miles per hour in the corrected time of an electrically operated measuring instrument. Again, these fast runs are frequently based on the time a train

is reported by telegraph operators as passing certain stations, in which event there is an easy chance for a large error to creep into the record.

While the ability of a locomotive to accelerate the speed of a train when running at a high rate is the prime factor, it is not the only considerable one. The resistance of the atmosphere and winds enter largely as controlling factors, and are very much greater at high speeds than low. An ordinary passenger locomotive, on level grade, can easily push a hole through it at fifty or sixty miles per hour; but quite a little before the 100 mile per hour mark is reached, the atmospheric and wind resistances become surprisingly effective. A side wind, in fact, retards speed more than a head wind, because of the flange friction it produces. In future high speeds these resistances must necessarily be given more prominent consideration than formerly; and doubtless some of the old, time-honored and "well done faithful servant, etc.," formulæ will need considerable mending or be permanently retired.

Agitating for Increase of Train Speed.

One day last month, a party of New York Central Railroad officials was traveling along the Lake Shore Railway towards Cleveland, and the temptation to indulge in fast running, promoted by the unusually fine track, was too much to be resisted. An unusually fast run was made and the rumor was immediately started that the fast run was not an accident due to opportunity, but was a test of speed deliberately undertaken to find out the shortest time in which a train could be run over the Vanderbilt system from New York to Chicago. The capabilities of the engines for maintaining a high rate of speed were declared satisfactory, and the would-be molders of public opinion informed the world that trains would be immediately introduced to make the run between New York and Chicago in 18 hours. The distance is about 946 miles so the average speed would not be much over 52 miles an hour, a velocity not considered great in these days of fast spurts. Particulars about this new train having been settled by the reporters, something new for paragraphs was in order, and so in a day or two the Pennsylvania people were reported to have decided upon putting on a new Chicago Limited which would make the run of 912 miles in 17 hours, or an average speed of 53.6 miles an hour. Those who have watched the regular running maintained by the Empire State Express of 53.5 miles an hour for 440 miles, do not anticipate that there would be any mechanical difficulties experienced in maintaining a speed of 53 miles an an hour, between New York and Chicago. The report that the fast trains were about to be put in operation, caused considerable talk among the traveling public and railroad men, but after a few days both the railroad companies made official denials that such acceleration of trains was contemplated and so for the present the incident is closed, or rather, never was opened by the railroad companies.

The incident illustrates the great interest taken in fast trains, for nearly every newspaper in the country published something about it, and many of them aired their ignorance of the difficulties that railroad companies encountered when they proceed to increase the speed of fast trains ten or fifteen per cent. As people become accustomed to very high train speed, and find that there is nothing alarming in the sensation of passing through space at 60 miles an hour or more, they develop a desire for more of it, just as a boy wants faster and faster speed in sliding down a hill on a coaster, and as the overgrown boy endangers the lives of pedestrians by speeding up his automobile to its highest velocity. An eighteen hour train between New York and Chicago would no doubt be very popular and a train that would cover the distance in ten hours would be more popular still; but the traveling public are not prepared to pay the cost of moving trains at abnormal velocity, and until they are prepared to do so, railroad companies will continue to keep close to 50 miles an hour for their highest average, except in special cases like the runs between Philadelphia and Atlantic City which have elements of advertising that stimulate the motive power more than questions of utility.

The experiments that were made in Germany last year, with electrical traction on a short railway between Berlin and Zossen, indicated that electricity could be employed to propel railway cars at enormous speed, but they were more in the nature of scientific experiments, than work done for commercial purposes. A speed of about 100 miles an hour was reached when the inspector in charge intimated that the limit of safety had been exceeded on account of the yielding nature of the track. Since those experiments were made we have been hearing a great deal about the necessity for accelerating the speed of express trains to one hundred miles an hour average. A curious thing about the agitation maintained about the desirability of trains being run at one hundred miles an hour gait is, that scientific men and sensational newspaper writers give it nearly all the support received. The people who would have to pay the expense of running trains at extraordinary speeds are not heard from at all. The scientific men are solicitous to see our prevailing train speeds doubled because the bringing into action the concentration of great physical forces for speed purposes would imply scientific progress; the newspaper man advocates abnormally high train speed because it is a good subject to write about and no knowledge beyond glittering generalities is needed in the production of an article on the subject.

If the traveling public should at any time make an earnest demand for trains to run from New York to San Francisco at an average speed from start to finish of 50 miles an hour they would be accommodated; but they would have to pay for the luxury in rates considerably higher than those now charged on existing express trains.

The distance between New York and San Francisco is close on 3,200 miles, a long journey which could be passed over in about 64 hours if the speed including stops were maintained at 50 miles an hour. To accomplish this would require every railroad in the long chain to have its machinery, its road bed and its train movement keyed up constantly to the highest pitch of efficiency. The experiments made by the management of the Chicago, Burlington & Quincy Railroad, with fast and slow train speeds, and reported to the Railway Master Mechanics' convention last year, demonstrated that to double the speed of a train from 30 miles an hour required double the quantity of water and coal and double the drawbar pull. From the particulars given in that report, we concluded that the expense of running trains 60 miles an hour are double that involved in running them 30 miles an hour, which is the prevailing speed for all except fast express trains. Although the wages of train men are not increased by increase of speed, a variety of other expenses are greater. None but first-class engines in excellent condition can be employed in hauling very fast trains, and they must be very rigidly inspected frequently, and substitution of parts made prematurely to guard against breakage or heating. A train that has to run a long distance at an average speed of say fifty miles between start and finish, has to be kept going ten or fifteen miles faster than the average to make up for slow downs and stoppages. When the New York Central Railroad Company made the fast run from New York to Buffalo of 60 miles an hour, as a preliminary to putting on the Empire State Express, the writer was time keeper and he found that the engine was losing time when one mile failed to be passed in 50 seconds. That is an average of 72 miles per hour, and it was well kept up, yet there was very little margin left when the train arrived in Buffalo. The route traversed was nearly level, with light gradients at intervals that put no particular stress upon the motive power. It was found that while the engine would maintain a speed of 70 miles an hour on the level, a moderate gradient if longer than a mile pulled down the speed to about 50 miles an hour. The distance of 440 miles was very well adapted for pushing a train through with the least possible detention. Had the distance been doubled considerable time would have to be lost putting a fresh sup-

ply of water and ice in the cars, and in inspecting the running gear of the train.

From what the writer has seen of the inside difficulties that have to be overcome in maintaining high speed for long distances, he does not believe that an average speed over 55 miles an hour, with a paying train, will ever be maintained between New York and Chicago with steam locomotives, unless some new form of boiler should be perfected which will boil water much faster than the existing multitubular boiler.

Safety of Railway Travel.

It is a long time since statisticians first informed the people that the safest place in the world was riding in a railway train. People occasionally lose their lives in America while traveling in railway trains, but it is becoming so rare in proportion to the volume of people carried that safety may be considered the rule. There was a time when nervous people were afraid to undress in a sleeping car for fear that an accident should happen and they would be exposed in nakedness to the rigors of the night. Exemption from accident has almost entirely dispelled fears of that kind.

The safety of travelers by rail is even greater in Great Britain than it is in America. Reports issued by the Board of Trade last month, the government bureau that has supervision of railway operating, show that not a single passenger was killed in the year 1901. This is the first time that a whole year has passed without a single passenger being killed and it is a splendid record, for the number of people traveling is immense. The fatalities to railway employees were extraordinarily few; eleven persons were killed and 161 injured, which includes railway employees and persons trespassing upon railways.

The Fellow Servants Iniquity Law.

We know of no single law which has been employed to inflict so much injustice as the so called "fellow servants" law, which is an inheritance of the English common law imported into this country before the Revolution. In times when this law originated, fellow servants were all acquainted with each other and if there was a reckless, careless or incompetent man among them whose dangerous characteristics were likely to put the persons of his fellow servants in jeopardy, they were expected to protest against that person being kept in the same employment. Under the industrial conditions that have developed in centuries, there are fellow servants whom others never come in contact with and whose personal characteristics other fellow employees have no means of judging. Nevertheless when an employee of a firm or company performs an act which results in the death or injury of another employee, the company is exonerated from responsibility and the blame placed upon the fellow servant. Some of our State legislatures have modified and others have repealed this outrageous law, among them the State of Arkansas.

A very good illustration of the injustice that the unmodified fellow servant law would inflict was recently given in a decision made by the United States Court of Appeals. A fireman on a railroad in Arkansas received very severe injuries in a collision caused by the failure of a telegraph operator to deliver a train order. The fireman sued the company and was awarded $16,000 damages on the ground that the fireman and operator not being fellow servants according to the Arkansas statute. Of course the case was appealed and the Court of Appeals has sustained the verdict of the lower courts.

We cannot think of any change of laws that would be more calculated to restrain flagrant injustice than a general repeal of this relic of barbarism, the fellow servant law. Labor unions ought to maintain unceasing agitation against these laws.

Aluminum in Locomotive Construction.

Only a short while ago cast iron entered largely in the structural parts of locomotive construction, and was, to a large extent, dead weight. In recent years, the desire to diminish the dead weight as far as possible has caused the substitution of cast steel for cast iron in many parts. This has materially lightened the useless load.

But in the future, in our pursuit for still less dead weight and lighter parts, may we not find further relief in the use of aluminum for reciprocating parts, etc.? Even that metal at present is prohibitively expensive and consequently beyond the reach of locomotive use; but may not its reduction be cheapened to a degree that will permit its use in locomotive construction? Might it not be so developed that it could at least be mixed with the iron or steel of reciprocating parts? A few years ago the use of cast steel for driving wheels, boxes, pawls, etc., was considered ridiculous; yet it came. Then why not cheapen aluminum?

A Case of Misplaced Cuts.

By a strange error the wrong cut was used as a detail of the Norfolk & Western consolidation, the outline of the New York Central Atlantic type being shown instead. It was a case of "all cuts look alike" to the printer and the proof-reader, but it isn't likely to happen again.

The right cut appears on page 240 and the other is used in the article on the traction increaser by Geo. S. Hodgins.

"Firing Locomotives" is the name of a new book by Angus Sinclair, recently published by this office. It is a very readable elementary treatise on combustion, suitable for the pocket. Price 50 cents.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters in the waste basket.

(137) J. F. B. asks:

(1) If an American has greater heating surface, in proportion, than an English engine, is it true that the former burns more coal, and if so why? A.—(1) The American engine has more heating surface, and usually burns more coal than a British engine. The American engine has longer, heavy, steady pulls to make than the British. The practice in this country may not be economical from a purely engineering point of view, but it suits the needs of American roads. The British engine is not forced as much as the American. English railway requirements are different to ours. Their freight business is more like a magnified express business, or a huge parcels post. Here we haul coal, grain, and ore in bulk in solid trains for long distances and we are expected to pick up an extra car or two at a way station when necessary. English coal is often more gassy than ours. Each practice suits the needs of the country using it.

(2) Is it true, and if so why does an American engine use more oil than an English engine? A.—(2) The British engine probably uses less oil because climatic conditions are more favorable to fine adjustment of oil cups, etc. Here we often have cold mornings, warm days and cool nights. Often a hot sun on one side of an engine, and cool shade on the other. The climate of Great Britain is more equable than ours.

(3) Is it true, and why, if so, does an American engine cost more for repairs than an English engine? A.—(3) The American engine is worked harder all round, and there are fewer of them per mile of road than in Great Britain.

(4) Is it true that machine work on an American engine is inferior to that of an English engine? A.—(4) The important working parts of an engine are finished as well or better in America as they are in Great Britain, but the general all round finish of an engine over there is better.

(138) J. R. writes:

(1) A Western engine with 2-inch diameter flues, 114 inches long, with firebox 110-inches long by 34 inches wide, and 39 inches high, having ribbed grates with plenty of air opening, and using a 3½-inch nozzle burns hard coal, does not steam well; why? A.—1. Anthracite coal gives the best results, in wide, long shallow fireboxes. The dimensions given are not those of an engine designed exclusively for hard coal.

(2) The tires wear fast, though the valves are carefully set; why is this? A.—(2) The wear of these tires is hard to account for the steel may be soft.

(3) What is the best kind of tire-drawing brake shoe? A.—(3) A shoe with steel inserts in flange and outside contacts generally gives very good results.

(139) T. G. E., Bandolng, Java, asks: In what way are the springs of locomotives and carriages hardened? A.—It is usual to have a cast iron water cistern about 4 feet long by 3 feet wide, having a running water supply and overflow. Within this is another cast iron cistern about 12 inches wide and 12 inches deep and about 3 feet 6 inches long, supported with its top edge a little above the water. This inner cistern is filled to about the water level with whale oil or sea oil or other suitable mixture, of which there are many, to suit the hardness of the steel used. The red hot plate, after having been set to the proper radius, is dipped into the oil and kept there until it gets to about 550 degrees F. or 600 degrees F. (light or dark blue), according to the grade of steel, and then it is immediately cooled off in the water bath. Much depends upon the experience of the operator.

(140) "Constant Reader" asks us to describe the manner in which a sight-feed lubricator works. A.—A sight-feed lubricator consists essentially of two chambers placed one on top of the other. The upper one is called the condenser and the lower one the oil chamber. Into the top of the condenser a pipe is introduced through which steam from the boiler enters. As soon as the steam turns to water it passes down through a small pipe leading to the bottom of the oil chamber. A valve placed at the back of the lubricator closes or opens this pipe, and admits or shuts off pressure in the oil chamber. The oil chamber having been previously filled with sufficient oil the accumulation of the water of condensation at the bottom of the chamber forces the oil up. It being lighter than water floats upon the top, always being under pressure. An upright pipe placed in the center of the oil chamber opens close to the top and receives the oil as it rises and flows over the upper edge of this central pipe. The oil having entered the pipe, passes down. At the bottom of the pipe two branches lead, one to each of the sight-feeds or glass tubes at the sides of the lubricator. The sight-feed glasses are full of the water of condensation from the condenser, with which they communicate. The oil forced along the branches passes up through the very small openings in the little nipples of the sight-feeds and leaves them in the form of drops, which being lighter than water struggle up through the glass and reach the passages which communicate with the tallow pipes. These are also full of steam and the water of condensation, and oil, water and steam flow down to the steam chest, which is fitted with a suitable valve adjustable to any pressure in the steam chest. A glass in front of the oil chamber serves to show the relative quantities of oil and water in the oil chamber.

AN AUSTRALIAN SMASHUP.

(141) C. K. J. asks: What is the effect of lead or no lead? A. Lead is the amount of port opening when the piston is ready to begin its travel. In order to be open at this point it must begin opening before piston reaches end of stroke and so form a cushion for piston as well as warming up parts and cylinder with live steam. Compression also aids in this. Many consider lead necessary to start an engine or make it smart, but we must consider that the crank pin is on the center when lead takes place, and that it can do almost no useful work until the piston has traveled two or three inches. By this time the port would be wide open, whether it had lead or not, and in the meantime the other side has started the engine. At slow speed there is no trouble about getting sufficient steam into cylinder, and with an engine hooked up, the port is open as wide as it will be by the time the piston has traveled three inches.

(142) R. J. B. says: A claims that in making a flying switch the tendency to prime could be reduced by opening the fire door at the commencement of the "fly." B says it would increase priming and be injurious to the boiler. Who is right? A. The more rapidly steam is generated the greater the tendency to prime, but we do not believe opening the door will affect this to any extent. It is not good practice to have furnace door wide open when working hard, as the cold air drawn in has a tendency to set flues leaking. Best practice is to open door just far enough to prevent tearing fire too much.

(143) A. V. E. writes:

We have an engine nere that the engineer complains of being lame. When, in running over the valves, I get them square in full gear, the cut off is out, one end cutting off at 3 inches while the other cuts off at 9 inches. Can you give me any information as to how the valves can be made to cut off evenly at all points of the stroke? A. The fault is probably in the planning of the valve motion and may not admit of a perfect remedy. Moving the suspension stud might help, but that is by no means certain. The usual course in such a case is, to square the valves at the point where most of the work is done, and let the other points hop along as best they can.

If George H. Daniels "forte" had not been in the make up of the best general passenger agent we believe that he would have worn laurels as the best editor. His work on the *Four Track News* is sufficient to prove that Mr. Daniels knows what readers with traveling affinities like and he knows where to find people who can write the things that will please his readers. His latest attraction is the story of The Prophet's Chamber. The mention of that will send the minds of people trained in Bible lore away back to the Shunamite woman. If any of our readers hanker after full particulars they had better send five cents to George H. Daniels, Grand Central Station, New York, and they will receive the entire story and several others. It will be of special service for people in the country looking for summer boarders.

Another new departure to be taken by the Reading in connection with the inauguration of its hourly express train service between Philadelphia and New York will be the uniforming of the engineers and firemen on those trains. The suit, or uniform, consists of overalls and jumper of black duck, with a white stripe, and two caps, one for summer, the other for winter, with the name "Reading" on the front of the crown. The idea, while new in the East, is largely in vogue upon western roads.

Air=Brake Department.

CONDUCTED BY F. M. NELLIS.

The Air Brake Association Convention.

The ninth annual convention of the Air Brake Association was held in the Assembly Hall of the Monongahela House, Pittsburg, Pa., beginning April 29 and continuing in session for three days.

The convention was duly opened by the representative of the mayor, who spoke of the advantages of Pittsburg and welcomed members of the association to the city.

President Best then read his address to the convention. It was a review of the past year's progress in the air brake art, and an outlook for the coming year. It contained many valuable suggestions, part of which were acted upon at the convention, and part which will be acted upon hereafter.

The reports presented by the committee were good, as usual, and provoked lively and instructive discussion. While all papers were especially fine, the paper on frozen train pipes was unusually so, inasmuch as it contained the practical experiments which the committee made on the Boston & Albany Railroad and N. Y., N. H. & H. Railroad with a view of determining the direct cause for the ice forming in train pipe in winter time. The report was excellent in detail, and, when summed up, it believed the principal cause to be due to too short a delivery pipe from the air pump to the main reservoir, thus permitting air pressure to be delivered to the main reservoir in an extreme heated condition. The main reservoir was unable, therefore, to cool the air down much further before it was delivered to the train pipe. As the air passed back in the train pipe hot, the moisture, which should have been deposited in the main reservoir, was deposited in the train pipe. A more liberal length of delivery pipe was recommended by the committee as a general remedy to obviate the difficulties above mentioned.

An excellent programme of entertainment was arranged for the members and ladies of the convention. On Tuesday afternoon, the ladies were taken in carriages to Carnegie Hall, where the gentlemen joined them later and were entertained by an organ recital, after which they visited the Carnegie Museum and art gallery. Wednesday afternoon the ladies were taken carriage riding. Thursday afternoon, the members visited the Westinghouse Air Brake Company's works at Wilmerding. In the evening the Westinghouse Air Brake Company entertained the members and their ladies with a theater party. Thursday afternoon a special train carried the members to the Homestead Steel Works.

The convention adjourned Thursday afternoon after electing the officers as follows:

President, J. E. Goodman; first vice-president, W. P. Huntley; second vice-president, E. G. Desoe; third vice-president, John Hume; member executive committee, P. J. Langan; treasurer, Otto Best; secretary, F. M. Nellis.

Colorado Springs was selected for the next convention, the time of meeting to be later arranged by the executive committee.

Air Brake Convention Items

It was the ninth annual convention.

Nearly two hundred names of members were placed on the roll call.

The ninth annual convention is past. Colorado Springs will get the next one.

The entertainment programme was a good one, and the committee deserves much credit for its work.

Not such a poor convention, after all, even though refusal of transportation kept many members at home!

It was one of the most successful conventions in the history of the association, both in point of work done and in attendance.

Quite a number of familiar faces of older members and their ladies were missing, and was, no doubt, an effect of the curtailment of passes.

To cool the main reservoir air the committee on frozen train pipes found an additional length of pipe between the pump and first main reservoir would give best results.

After considering the findings of the committee it is quite apparent why frozen train pipes are almost invariably found on engines having a very short pipe between the pump and main reservoir.

If any higher tribute to the Air Brake Association's value and work were necessary, it was supplied by the considerable number of members present who paid their own railroad fare and expenses to attend the convention.

Three committee reports proved ample this year. The convention occupied three days, and no time was found for topical discussion. Possibly still fewer committee reports and two or three lively topical discussions would be better yet.

The names of the ex-presidents of the Air Brake Association are herewith given in the order of their election, as follows: Robert Burgess, C. C. Farmer, S. D. Hutchins, M. E. McKee, C. P. Cass, R. H. Blackall, W. F. Brodnax and Otto Best.

Only one of the ex-presidents, Otto Best, is an active member in railroad employ. Mr. Brodnax is with a firm outside of railroading, and the remainder of the list have accepted service with the Westinghouse company since sitting in the presidential chair.

The committee on yard testing plants, while submitting a comparatively brief report, presented some valuable practical information that could be used with benefit by many railroads at present having primitive and inadequate methods. The paper provoked a lively discussion.

Mr. Clendenning's indefatigable efforts to elect Colorado Springs were deserving of success. Many of the members voted with this in view, rather than a knowledge of the place being a desirable one to meet in. However, Mr. Clendenning's recommendation and the West deserve a trial.

For the first mechanical railroad convention to meet since the anti-exchange pass agreement, the Air Brake Association did very well; but there is no doubt that the pass restriction was severely felt, and hit hard where the agreement did not intend it should.

A longer delivery pipe between the air pump and main reservoir will permit the heat in the compressed air to radiate and dissipate before the main reservoir is reached. Hence the moisture is deposited in the reservoir where it should be. So the committee's tests have demonstrated.

One notable feature of the convention was that part of the discussion which disclosed the practice of some roads to attempt no work on air brake parts on the engine, but to substitute a part in good repair for the reported defective part, thus making all the parts "first in, first out."

There is moisture in all compressed air, and if it is not deposited in the main reservoir, it will be found somewhere back in the train line. A goodly quantity of deposited moisture in the main reservoir is a favorable indication. No water in the main reservoir after hard pump work is a correspondingly unfavorable indication.

The committee on round house air brake work submitted a commendable paper. The observations of the committee were thorough and effective. Their recommendations were varied, concise and comprehensive. Besides containing valuable advice and suggestions to shop men, the paper was liberally illustrated with devices intended to ease the air brake man's work and render it more efficient.

The Westinghouse Air Brake Company did itself proud, and showed substantially its appreciation of the selection for a meeting place the city where nine years ago, the Air Brake Association was formally organized. The special train which carried the members and their ladies to the Wilmerding works, the trip through the works, the theater party of nearly four hundred persons, the organ recital in Carnegie Hall and carriage drives for the ladies will long be remembered as happy incidents of a most successful convention.

The discussion brought out the fact that a very considerable number of roads now remove the brake valve, pump governor, air pump and other parts from the engine to make repairs, and attempt to do no work on these parts while they are on the engine. This is undoubtedly a good practice, as experience has proved, for better examination can be made of the parts in the air brake room than on the engine, especially if the engine be cold and the work report insufficient or faulty. Again, better work can be done under favorable conditions at the vice bench than on the engine where room is scanty and operations are restricted.

A number of souvenirs were distributed by the different supply firms. The Westinghouse Company presented each visitor to its works on Thursday afternoon with a very neat aluminum model of the brake valve and seat. Locomotive Engineering presented a handsome purse for coins. The International Correspondence Schools gave away a pretty aluminum-cased lead pencil. The Kent Lubricating Company distributed a neat little celluloid case on which was a 1902 calendar, and contained sticking plaster and a holder for postage stamps. The *Fireman's Magazine* distributed handsomely gotten up Desoe charts of the air brake system and signal line which, when rolled up, fitted into a neat black tube with a cap.

Probably one of the best papers ever presented to the Air Brake Association was the committee report on frozen train pipes. At least this is true so far as practical utility goes. The subject of frozen train pipes has been a prominent one for a few years back, and has been an ever possible menace to train safety. Various schemes have been tried to remedy the trouble, but none have contained sufficient merit to warrant their general adoption as a sure prevention. The committee, after thorough and careful test, have discovered a sure preventative, viz.: Cool the compressed air in the main reservoir to the temperature of the surrounding atmosphere before permitting it to pass back into the train pipe.

An amusing incident transpired when President Best called on "the man from Mexico" to speak to the convention on the air brake situation in Mexico. There were two such men present, each unaware of the other's existence and presence. Both rose simultaneously from opposite sides of the room and began talking. The facts quickly dawned on the members. A murmur ran around the room, gradually grew into suppressed chuckle, and finally ended in merry applause. The president's gavel fell with a rap on the table and called the convention to order. "The man from Mexico" in duplicate grasped the situation, crossed the room, met each other in the main aisle, introduced themselves and greeted each other like the Two Dromios.

It was fitly and truthfully said in the corridors of the Monongahela House, the convention headquarters, by an old time air brake man who had recently joined the association and was attending his first convention that the Association conventions were schools of instruction where a man is kept up-to-date in air brake practices. He was right and could have gone farther; for not only is the convention hall an instruction room, but each group at table, in the lobby, in the rooms, on trips about town—all are schools where the timid, hesitating member unloads himself and tells far more than he could on the convention hall floor. The whole substantial talk of a convention does not appear in the printed proceedings. The comparing of notes and practices after convention hours tells a good deal more. There is not a single air brake man that a railroad company can really afford to keep away from Association conventions.

He had taken in the organ recital tendered the convention Tuesday afternoon at Carnegie Hall by the Westinghouse Air Brake Co., simply because it was free and he didn't have anything else to do. He didn't know a thing about music and didn't pretend to; but he seemed to get considerable enjoyment out of it nevertheless, as his following account of the entertainment will attest:

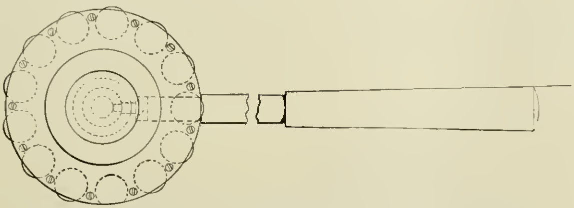
"Gee whizz! Bill, ye orter been there an' seen that little pale chap do the wiggle up at the music foundry this af. Say! he could cover more territory than any base ball player or prize fighter you ever seen. Tan my hide if he didn't play that organ more with his feet than he did with his hands! Side step? Why! he's a wonder! An' a hitter, too! Say! he soaked more straight punches, swings an' uppercuts into that ole music box than would put nineteen hurdy gurdies out o' business. An' how she did beller an' screech! He started off with a bit of a wiggle up in them little yellow pipes in the left hand corner o' the shootin' match, an' sounded like workin' the water out of a cold pump. She jiggled a bit an' then took holt. It seemed as though the little, pale music chap seen it was up to him to make good, an' he went ahuntin' the lucky numbers. He found 'em, too, an' was up to speed in a second. Say! ye orter heard the roar! The Empire goin' over a steel bridge was dead quiet beside that racket. There was a bellerin', an' roarin', an' thunderin' up in them long pipes at the right, that I felt sure they'd bust an' a million car wheels come arollin' out an' down on the stage any minute. Say! this aint no kiddin', fellers, it's on the dead. I can't see, for the life of me, where that little, sorrowful lookin' chap with the pale complexion and long hair got the muscle to do it all. Say! he was all to the good! An' don't ye think for a minit he couldn't mix things up, too. He'd go limpty-limp down the line like a duplex pump. Then his 90-pound governor 'd check him an' he'd steady up a bit, an' she'd clickety click like a six-wheel truck over an open joint. Then he'd land a straight left lead hard into her solar plexis, an' Hully Gee, she'd squeal like a hard brake shoe on a chilled wheel! Tan my hide if it wasn't fine—out o' sight! But when he turned into the homestretch an' made fer the wire, it was a hair raiser sure. Cracky! He kicked with his feet an' handed out swings an' uppercuts with his hands, till I thought he'd fall off the stool. Then I made a fool o' myself. "Hold 'er down, Bill," says I, pretty loud, for he had me all excited. "Give 'er sand! Ye may have to slide, but fer crack sake bring in that run! Slide!" Two or three guys—one o' them from Mexico, called me down an' said fer me to be decent. But I couldn't help it, fer I was enjoyin' it so. Say, he was a winner! Finally he sidetracked the tremolo business, an' kicked both feet into the bass at once, an' ye orter heard the thunder and earthquakes, and boiler explosions and head-end collisions. Hully Gee! When he quit he was all in He mopped the sweat off his face

like a back-shop feller packin' a hot pump. Then them swelled up guys what pretended they knowed music, clapped him, an' so did I, fer I guess we all enjoyed it. I pitied the poor duck, fer workin' so hard, an' after it was all over, an' thinkin' he orter be complimented fer makin' good, I went up to him an' says, says I, 'Ol' man, yer all right! If you'd only had about two more hands and three more feet, an' about forty pounds more beef on ye, ye'd busted the ol' machine, sure. Yer aces up an' all to the good. An' yer my friend! If ye ever drift over my way, an' are broke, I'll chuck a square meal into ye, an' have ye deadheaded over the road, any time. Ye did yer stunt bully. I took more stock in it than anything I've bucked up against since the Jeffries-Fitzsimmons scrap at Coney Island three years ago. Yer all right, put 'er there,' says I. He must have 'preciated the compliment for he shook hands and laughed."

CORRESPONDENCE.

Slid Flat Wheels in Cold Climates.

I notice in your May issue the first article in the Air Brake Department, the subject of "Flat Wheels" caused by leaky gaskets in the hose in cold climates, that the leak is so great that the pump will not supply it. This you say causes a reduction in the train line, the brakes to apply, and slide the wheels.



ROLLING AND EXPANDING DEVICE FOR TRIPLE VALVE BUSH.

In reading this over, a few thoughts have presented themselves: If, as you say, when the train is standing still it does not leak, and when it is started this leakage does occur, the brakes would go on, and it would seem to me, stop the train and not let it get up to any speed or go any distance.

Again, what is the engineer doing all this time? Does he never look at his gage and see his excess pressure going away, with the hands doing the "skirt dance" down the dial, or feel his train stopping or slowing down and his dropping her down a notch or two does not help her any? If the gaskets leak like this, would they pull a train far enough to flatten the wheels? for if one car went down, surely all the rest of them would do the same; or, perhaps they do not give them "drag outs" up in the cold north, and his engine would be capable of pulling all these air cars with brakes set.

The fact is, I do not understand this article, but I want to, and that desire is what prompted me to ask this question.

Very respectfully,

C. W. Fritsch,

Western Maryland R. R.

Hagerstown, Md.

[A person having had air brake experience on long freight trains in very cold climates, has observed that air hose will freeze so stiff that it is with much difficulty that the hose can be coupled and uncoupled. They will stick out like prongs from the end of the car and baffle all efforts to place them in the ordinary dummy coupling. A train with hose in this condition may be tested when standing still and be practically tight; but as soon as the train is stretched, the draft springs compress, lengthening the distance between the cars, and the hose, instead of stretching or straightening out, will remain rigid and cause the coupling faces to slightly slide along on each other, until a considerable leak is made. A number of such leaks will waste away a surprising amount of train pipe pressure, cause the pump to heat and the brakes to drag. A stuck brake on a standing car will easily skid a pair of wheels when the train is started. All brakes are not affected alike by train pipe leaks. Some triples are more sensitive than others, due to their condition. The same is true of brake cylinders also. The leakage groove may be stopped up in some, and packing leather leak in others. It must not be understood, therefore, that train pipe leakage will affect all brakes alike and produce similar results on all. The "skirt dance" referred to would not be experienced, as the pressure would not fluctuate, but instead would merely fall and severely tax the pump to keep it up.—Ed.]

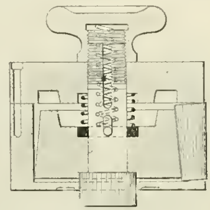
About Frozen Train Pipes.

I would suggest that the hose coupling between the engine and tender would be made in one section instead of two, as I think the cast iron coupling that connects the two parts retains a lower temperature than the hose, and having a small passage through the coupling it will freeze a great deal quicker than the hose will. When we look back in the first years we used the air brake, the hose between the engine and tender was never known to freeze. Now it is a common occurrence in cold weather.

A. J. O'Hara, Erie R. R.

Port Jervis, N. J.

[We had short trains then, and the air pump did not have to work hard to supply the quantity of air used by the brakes. Consequently hot air was then unknown



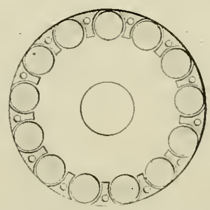
SECTIONAL VIEW, VERTICAL PLANE, TRIPLE VALVE BUSH ROLLER.

to pass from the main reservoir to the train pipe, to cool and deposit its moisture there, as it does nowadays with a hard-worked pump and long trains. See condensed summary of the Air Brake Association's committee report on this subject elsewhere in this department.—Ed.]

Slid-Flat Wheels Due to Journal Friction.

Regarding the matter of slid-flat wheels being more numerous in winter time, due to the friction between the axle and the brass in the journal box I would say that it did not occur to me that this feature was an important one, or one which would materially contribute to slid-flat wheels; but the more I think of it, the more I believe your views in the case are correct.

We all know that a train is harder to pull in winter time, because the oil in the journal box is frozen and does not furnish the lubrication that it does when warm and thin in summer time. Again we have



SECTIONAL VIEW, HORIZONTAL PLANE OF TRIPLE BUSH ROLLER.

all had the experience of a train pulling harder when there were two or three hot boxes in the train. I believe that a very large proportion of the slid-flat wheels in winter time, especially in our extreme northern climates, is due to insufficient or improper journal lubrication.

I would suggest that some of our northern friends would experiment with this

feature next winter, using thin, light-bodied oil in winter time for journal lubrication in comparison with the ordinary oil that is used on journals, the whole year round. I believe we would get some good practical information on this subject in pursuing such a course.

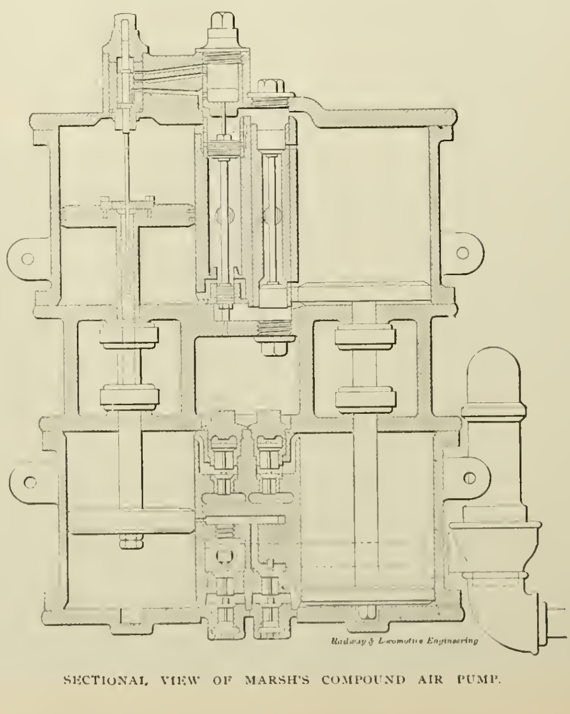
Boston, Mass. AMOS JUDD.

A "What Is It?" Puzzle.

I enclose you a print of a compound air pump as a puzzle for your readers to guess what it will do. All the cylinders are the same size, and the high-pressure steam piston is driven by the old eight-inch Westinghouse valve motion. One of the pumps has been made and tried, and the result known to myself. Let us have some guesses on it. G. W. MARSH.

Oakland, Cal.

MARSH'S COMPOUND AIR PUMP ON ENGINE.



SECTIONAL VIEW OF MARSH'S COMPOUND AIR PUMP.

[In a later communication Mr. George Marsh sends a solution to the puzzle and says: "This is a compound air pump. It will pump one more atmosphere each stroke than will the Westinghouse eight-inch pump, of which it is a double of cylinder area, and with the same amount of steam which the eight-inch pump uses in pumping one atmosphere, which is a gain in economy of one-half. The compound makes but half as many strokes, half as much noise, and runs much cooler than the high pressure pump, while doing the same amount of work. It will pump one-third more air than the eight-inch pump at about the same temperature."—Ed.]

Suggestion to Abolish Quick Action.

Now as our cars are getting pretty well equipped with the air brake, it brings us face to face with another dangerous feature that is more dangerous than it was to run without the air brake. That is, the bursting of the hose between the cars. The cars are not quite all equipped as yet, and when they will be, I fear that it will be more than one 9½-inch pump can conveniently take care of, with all the leaks there is to be supplied on a train of 80 or 85 cars.

We find a number of men who will say that this can be done satisfactorily. I also say it can be done if the train line is perfectly tight; but the every-day train is not tight. Nor is it nearly so. It is far from it. It is about all a good pump will do to keep the train line up. Now if we have to handle those trains in the above mentioned condition, and I think we will, I suggest that we be furnished with another pump, or a larger pump. Also larger reservoirs, so we can keep up train line recharge quickly without burning up the pump.

Now getting back to the hose bursting proposition. That is probably more serious than many would think it was on the first look and thought. Upsetting the conductor's furniture by the shock is considered bad. Shifting the load in the cars is still worse; but the bursting of a hose on a partly equipped train does not stop at that, it goes farther; and throws the cars on the rear of the train off the track, and too often over on the opposite track. This is pretty serious to think of, especially when you are on a fast train running in the opposite direction at the rate, say, of 50 miles per hour. Do not think for a moment the hose will wait until the fast train passes. They are liable to burst any time or place.

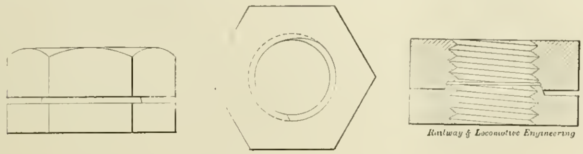
Now that we know this is the situation, what are we going to do about it? I suggest we take off the quick action valves. By doing this we reduce the brake power from 10 to 15 per cent., which will reduce the shock on the rear

of the train to a great extent. Now I do not want to be understood that I want the companies to go to the expense of buying new triple valves and scrapping the old ones. I would make the change by taking the quick acting valve spring out and putting a thimble in its place, thereby blocking the valve so it will not work. We will not miss it as we never use it.

I think this would be the means of saving many wrecks that we are liable to have. As we become more fully equipped with air brakes, the more hose we have and the more chances of bursting.

A. J. O'Hara,
Engineer, Erie Railroad.
Port Jervis, N. J.

[We have very good reasons for doubting that the many break-in-twos of trains and consequent damage to cars, etc., such as are credited to bursting hose and the quick action feature of the triple valve are justly due to the causes cited by our correspondent. We would invite criticism and discussion of our readers on this subject.—Ed.]


THE COFFIN MEGEATH LOCK NUT FOR AIR PUMPS.

Good Record for Air Pump Piston Lock Nuts.

We send you herewith drawings of the McLaughlin lock nut, owned and manufactured by the Coffin-Megeath Supply Co. This is a lock nut that locks. It is in use on nearly 900 locomotives on the Boston & Maine Railroad, and such a thing as nuts working off the piston rods of these air pumps is a thing of the past.

J. S. Coffin.
Franklin, Pa.

Feed Valve Attachment for "D8" Brake Valve.

I have invented a valve, or rather a feed valve attachment that will or can be attached to the "D8" engineer's brake valve, that will make the "D8" valve as good on any kind of a train, as the "F6" or "D5," by connecting the governor to the main reservoir pressure.

This valve can be so constructed, that all that is necessary to attach it to a "D8" valve, is to unscrew the cap nut for excess pressure valve, and screw in the feed valve, connect the governor with the main reservoir pressure, and you have a brake valve that will do the same work as the "F6" or "D5" brake valve.

I would thank you very much to advise me whether or not there would be a demand sufficient to pay me to bring this valve out and whether you think the D8 brake valve will be in use long enough to justify investigating such an improvement.

William L. Terry.
Hearne, Texas.

[We would not encourage one to spend money on any arrangements to work with the D8 or 1890 model brake valve, as this valve is rapidly passing out and is already extinct on a large number of roads. The manufacturer has offered such attractive inducements to railroads to turn in the D8 or 1890 model valve in exchange for the F6, 1892 model, that many have done so and others are now doing it. Again, the 1892 model has so many advantages over the 1890, or D8 valve that the older one will naturally be replaced in a short time by the newer one. Hence, our advice.—Ed.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(137) S. L. M., Cincinnati, O., writes:

Is the high-speed reducing-valve so constructed that it will reduce pressure from the cylinder as fast as the graduating-port of the triple will permit it to expand in to the cylinder, in making a service-application? A.—Yes, by a very liberal margin.

(138) J. S., Oshkosh, Wis., asks:

Why must brakes be fully released before uncoupling hose to set out a car? A.—For the reason that cars are usually set out on a siding by "kicking" them; and should the brake be partly set, it would drag and probably stop the car before it got in the clear, thus causing the unnecessary work of a second attempt.

(139) G. E. C., Moncton, N. B., Canada:

Why was the old feed valve attachment replaced by the slide valve feed valve? A. —The old feed valve attachment would charge up quickly to within 3 or 4 pounds of what it was set for, then finished very slowly. The slide valve feed valve attachment feeds right up quickly to what it is set for, and closes quickly.

(140) G. E. C., Moncton, N. B., Canada:

Why is the air pump now placed on the left side of the engine. A.—This is the practice of some few roads only, and it is done so that the pump shall not be an obstruction to the engineer's view. Again, the arrangement of the fixtures on the engine is sometimes so that there is more room for the pump on the left side.

(141) S. L. M., Cincinnati, O., writes:

As the high speed reducing-valve is intended to reduce cylinder-pressure while the speed of the train is being reduced from a high to a moderate rate—how many seconds does it require to reduce the pressure from—say a 10-inch cylinder with an 8-inch piston travel from the maximum pressure obtained by 110 pounds train-line pressure to 60 pounds in the cylinder? A.—About 20 seconds.

(142) J. S., Oshkosh, Wis., asks:

If several cars with brakes cut-out are placed together in an all air train what effect will it have on the brakes? A.—Quick action application on the cars behind the cut out cars can not be had, as a violent enough reduction cannot be made in the train pipe of the cut out cars to actuate the emergency parts of the first quick action triple behind those cars cut out.

(143) G. E. C., Moncton, N. B., Canada:

Is the feed groove of a passenger triple larger than that of a freight triple, and if so, why? A.—Yes, in modern triples. The endeavor is that all triples shall charge their auxiliaries in the same given time, about a minute. The passenger auxiliary reservoir, being larger, if it shall charge up in the same time as a smaller one, must have a triple with a larger feed groove than a triple which charges a smaller auxiliary.

(144) J. S., Oshkosh, Wis., writes:

Why was the quick action adopted in place of the plain triple, and why is it so called? A.—The plain triple applied the brakes on a long train in emergency too slowly, causing the head brakes to set much earlier than the rear ones, thus permitting the slack to run in with destructive force. The quick action triple sets quicker (in the emergency), and with about the same speed that the slack runs in, thus doing away with the shock. For this reason it has been given the name.

(145) J. S., Oshkosh, Wis., writes:

Under what conditions, and why will a leaky graduating valve in a triple valve cause that triple to release the brake? A. —The slide valve must leak too, or it won't do it. With this combination of leaks, auxiliary pressure can leak out into the atmosphere, or into the brake cylinder, if the brake is not fully set, thus reducing the auxiliary reservoir below the train line pressure, which has been undisturbed. This is equivalent to slowly reducing auxiliary reservoir pressure at the bleeder cock, and the triple will go to release position and the brake whistle off.

(146) J. S., Oshkosh, Wis., asks:

Why is it that with a train of quick acting triples you cannot obtain quick action by making a gradual reduction of train-pipe pressure? A.—The pressure in the auxiliary reservoir can escape through the graduating port into the brake cylinder as fast as the pressure in the train pipe is being reduced. If the train pipe reduction is faster than the auxiliary reservoir reduction, the triple piston will be pushed by auxiliary reservoir pressure past graduating position to full stroke, and a quick action application will result.

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(147) J. S., Milan, Mo., writes:

In reference to Question 158 in May number, what connection can we make on the 8-inch air pump suctions to compound? A.—Special connections must be provided. On the inlet at the side for the upper receiving valve, a suitable brass casting may be made and fitted to the side of the air cylinder. This should be air tight, of course, and have a union connection for a pipe. The lower inlet, for the lower valves, may easily have a piece brazed to it to give a pipe connection. This is assuming that the pump in question is the second, or high pressure pump in the combination.

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(148) G. E. C., Moncton, N. B., writes:

A 5-pound reduction is made on a train of 25 freight cars equipped with Westinghouse quick action triples, and all brakes apply. In a minute or two another 5-pound reduction is made, and one triple goes into emergency, causing the rest to do likewise. What caused this triple to go into emergency while the second 5-pound reduction was being made, having applied its brake in service when the first 5-pound reduction was made. A.—Possibly there was a leak in the slide valve in graduating position which permitted auxiliary pressure to leak to the top of the emergency piston. This, assisted by a broken graduation pin would cause the triple to act as described.

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(149) J. K. F., Oelwein, Iowa, writes:

If a man has a slow order to come down to four miles per hour, could he, by wheeling them up close, then making about ten pound reduction and bring his train down to the required speed (4 miles), release and have less chances of breaking the train in two than he would by making his application earlier and only use about a 5 or 6 pound reduction? With a long freight train would he not be just as likely to break the train (by releasing at slow speed) with the heavy reduction as with the light one? A.—The chances of breaking in two would be greater with the heavier application, no matter whether it were made as one whole one or two partial ones. The lighter the application, the less the chance of breaking in two.

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(150) S. L. M., Cincinnati, O., writes:

With cars that are calculated at 80 per cent. braking-power when the train-line pressure is seventy pounds, and the high-speed attachments were placed on these cars for 110 pounds train-line pressure, with the train running at 40 miles per hour and the brakes applied in the emergency from some cause, is it likely that the wheels would skid before the train had reduced speed to 30 miles per hour and continue to slide until the train had stopped? A.—There might be such danger with the old practice of fitting the same sized reducing valve to all brake cylinders, regardless of whether they were 10, 12, 14 or 16-inch. The result might be that the large cylinders would reduce too slowly with the trouble above mentioned. However, with the present practice of fitting each brake cylinder with a specially adapted reducing valve, no trouble may be apprehended.

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(151) G. E. C., Moncton, N. B., writes:

In your answer to Air Signal Question 162 in the May issue, you say the pulls are probably made too close together, and that they should be of about one second duration, and one second between pulls, as the whistle gives one long blast when the cord is pulled two or three times close together. Would it not require two or three seconds between pulls on a long train, and especially so if the diaphragm stem of the signal valve worked stiffly in its bushing? Would not one second between pulls produce the same effect as though the pulls were made too close together? A.—On long trains the two seconds intermission between pulls would doubtless be more satisfactory, especially under the conditions you mention. The longer the intermission the less is the tendency for the blasts of the whistle to run together and make one long continuous blast.

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(152) R. S., Invercargill, New Zealand, writes:

On page 19 of Conger's 1898, air brake catechism, it says: "The brake piston travels an inch further when train is running than with a standing test." Will you please explain the reason in your air brake questions? A.—The slack in the brake rigging, the lost motion in the center bearing of the car body where it fits into the center bearing of the truck, and the lost motion in the journal boxes, brass bearings and pedestals can be taken up closer as the car jolts when running; hence, the greater piston travel when running. This may be compared to a bag filled with apples or potatoes. The apples or potatoes may be placed in the bag until it is full, but if the edges of the bag are held and the contents jolted down, the bag will hold more apples or potatoes. In the case of the car, the tilting of the truck also contributes to greater running travel. This subject is fully treated in the Baltimore proceedings of the Air Brake Association.

(153) G. E. C., Moncton, N. B., writes:

In your answer to Question 147 in the April issue, you say possibly the leakage groove is stopped up and the slide valve stays on its seat because of strong springs on its back, or sticky oil. In answer to Question 157 in the May issue, you say if the leakage groove is not clear and the slide valve seat is well oiled, the slide valve will resist the tendency of the brake cylinder air to force it off its seat, and so on. Which is right, sticky oil, or well oiled? Does it not depend mostly on the tension of the slide valve spring whether the brake cylinder air lifts the slide valve or not? A.—It doesn't matter in this case whether the slide valve is well oiled with clean oil or whether the oil is sticky. Both conditions will resist a straight upward effort to lift the valve from its seat. Take a rotary valve (in brake valve), for instance, oil it well, and try to lift it straight upward without any twisting or tilting movement, and you will find a surprisingly strong resistance. It is this condition that holds the slide valve to its seat, in the case mentioned, even more than the spring on the back of the valve.

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(154) A. P. P., New York, writes:

If, as you say on p. 173 of current issue, the pressure in train line and main reservoir is 90 pounds with handle in full release position, where does the surplus 20 pounds escape to when the handle is placed in running position? If it does *not* escape, where is your excess for releasing; also, wheels may lock with such high pressure in brake cylinders. If it *does* escape, *how* does it—through where? A.—If the brake valve handle is left in full release position, the ultimate result will be that 90 pounds pressure will be had in main reservoir, train line and auxiliary reservoirs. Should the handle be now brought to and left in running position, there will be no communication between main reservoir and train line until the line pressure leaks down to 70 pounds, when communication will be established through the feed valve attachment. If the train line was absolutely tight, the pressure therein would remain at 90 pounds and there would be danger of slid-flat wheels. If it leaked, however, the auxiliary reservoir pressure would reduce also, either by feeding back into the train pipe through the feed port of the triple, or by passing into the brake cylinder by action of the triple. If the leakage grooves of the brake cylinders were stopped up, the brakes would drag and require "kicking off." If the train line was absolutely tight and the pressure was 90 pounds in both train pipe and main reservoir and a 10-pound reduction was made to apply brakes, there would be an excess pressure of 10 pounds (90 main reservoir and 80 train line) to release the brakes. This amount would doubtless be sufficient for a high speed train of usual length.

Locomotive Firing.

First Paper.

BY T. J. HOSKINS, TRAVELING FIREMAN, SOUTHERN PACIFIC RAILWAY.

THE SCIENCE OF LIGHT AND HEAT—THEORETICAL AND PRACTICAL POINTS.

The ancient philosophers regarded the sun as a molten, fusing body. The light and heat, as well as the mode of its formation, engaged their attention and was regarded as infinitesimal particles of its own body which were hourly being shot away. They gloomily pictured an age when this process, with its constant drainage, would reduce the sun to nothing and leave the earth in the desolation of lifeless and frigid darkness. But the learning of the day provides us with a more happy solution. It is now supposed that a medium, denominated ether, exists everywhere throughout the universe, mixed with and surrounding the particles constituting the common air. That as the molecular particles of the sun are in rapid vibration, they produce in this ether a series of waves which chase each other away at the rate of one hundred and eighty-six thousand miles per second, and striking upon the earth's surface are manifested to us as light and heat. Thus it is, as air is the conductor of sound, ether is the conductor of light; as sound is a series of waves produced by the vibrating of an object in the air, so is light a series of waves produced by the vibrating of a particle in the ether. However strange in comparison with our comprehension of them, each is but a "mode of motion."

LIGHT AND HEAT.

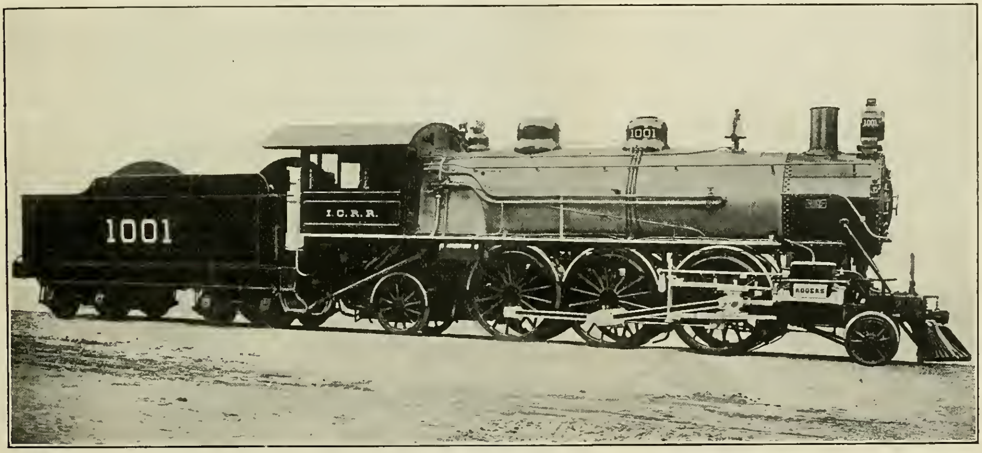
"The mill of the gods grinds slow, but grinds to atoms." In that mill we may place an object and stand by to see the process. At first, perhaps, it is broken into a hundred pieces, next into a thousand, next a million, and so on. Soon a particle is so small that we cannot see it separately, but only as a part of a mass unlike in character to the original, but we must of necessity know that the atoms are separate, because we have seen them in the process of separation. Introduce an agency among them now that sets each atom into violent motion. Against each other they clash and rebound only to clash again until the rapidity of their motion rivals the lightning's tremendous flash. As the conflict goes on atom after atom retreats, and we see them whirling and surging in the smoke above like a column of frightened soldiers in the distance retreating from the deadly carnage of battle. Touch your hand against this mass—it is hot; gaze intently upon it and your eye is ruined by its glare. Had we but Nature's "matchless eye" we might behold the atoms in the stone, as they separate lie, when it is cold; or, as when hot, they move in majestic circle around their perfect poles until the widening sphere moves them beyond the power of mutual attraction and they fly away, not destroyed, but to exist as first they were, in nature, separate entities all. But as it is we can only see them, when at rest, a gray and sullen stone; when in motion, a hot and glowing mass.

HEAT CONVERTIBLE INTO POWER.

Not only has one atom the power to attract another atom, but it has the power when set in motion to put an adjoining atom into motion also; and, in conjunction with other atoms they unite to form compounds and substances, the result of which is seen in earth and water, in plant and tree, in bird and beast; all classified by their admixture, made by an unseen master hand, to yield the harmonious order of things, as the artist by a mixture of paints makes them yield his desired effects upon the canvas. But in the process of separating atoms that are united and reuniting atoms that are separated, there is produced a motion, technically styled "molecular motion," commonly called heat. We place our coal upon the grates of an engine, the heat of the fire beneath it liberates the atoms of carbon, and in the fire-box space above they unite with atoms of oxygen from the air to form carbon dioxide gas. This is the process of combustion which, if complete, fills the fire-box with a motion which we would say, speaking technically, is molecular, but commonly, a white heat. These atoms of carbon and oxygen, being themselves in such an awful motion, according to the laws of nature, yield a part of their motion to the atoms composing the sheets and tubes which in turn yield their motion to the molecules of water surrounding them. This motion continues until it reaches the point which would be indicated by an ordinary thermometer as the boiling point, which varies according to pressure, when the motion is then so great that the atoms composing the molecules of the water are shaken apart and forced to exist as a gas, or what we commonly call steam, requiring many times their former space for existence, and by the pressure thus created we perform the work of moving the commerce of the world.

PROPORTIONS OF CARBON AND OXYGEN.

In ordinary bituminous coal such as is burned in our locomotives there is about 70 per cent. of fixed carbon. For each pound of carbon consumed there must be one and one-third pounds of oxygen. Without the necessary supply of oxygen the particles of carbon contained in the



ROGERS PRAIRIE LOCOMOTIVE FOR ILLINOIS CENTRAL—SEE FRONT PAGE.

coal would be as powerless to produce heat as if they were bits of sand. The fireman should remember that in burning his coal more than half the product of heat is derived from the oxygen contained in the air which is drawn in through the grates and combines with the fuel to produce heat. If the passage through the grates is restricted by carrying too heavy a fire, or otherwise, the flame will be what is known as carbon monoxide, not possessing one-third the heating power of a carbon dioxide fire.

PROPORTIONS OF HYDROGEN GAS AND OXYGEN.

In addition to the fixed carbon in the coal there is another product constituting about 20 per cent. of the whole, known as hydrogen. To burn one pound of hydrogen requires eight pounds of oxygen. These gases are volatile in character, and when combined with the requisite amount of oxygen burn with the hottest possible flame. In burning these the fireman should remember that the power of heat is derived from the coal, only by combining with the oxygen taken from the air.

COMPOSITION OF AIR.

Common air is a mixture of oxygen and nitrogen in the proportions of one pound of oxygen to one and thirty-five hundredth pounds of nitrogen. Thirteen cubic feet of air weighs one pound, but at the earth's surface it has a pressure averaging about 14.7 pounds per square inch. This is said to be its actual or absolute weight, and is proven by the fact that at a higher altitude the pressure is less.

AIR REQUIRED FOR EACH POUND OF COAL.

Actual tests have proven that for each pound of coal burned there is required the amount of oxygen contained in eleven and one-half pounds of air. As each cubic foot of air occupies thirteen cubic feet there is required one hundred and sixty cubic feet for each pound of coal burned. Even more. In order to burn the coal economically there must be a surplus of oxygen, so that there is needed not less than twenty pounds or two hundred and sixty feet of air for each pound of coal.*

LOSS OF FIRE GASES.

The process of combustion is a rapid one. The fire gases will average passing away through the flues at the rate of thirty miles per hour. There is nothing easier than to fail to have the required amount of air in the fire-box, and allow a portion of the gases to pass away unconsumed. A single pound of hydrogen gas, combining with eight pounds of oxygen, will produce an explosion, the force of which will equal that of the falling of a mass weighing 47,000 pounds from an elevation of 1,000 feet.[1] Yet for want of air this amount of heat may be lost in an engine every minute. There is twice this amount of hydrogen in every shovelful of coal thrown into the fire-box.

*See article on combustion "Engine Running and Management," Sinclair.

[1]See "Practical Points"—Farnum

THINGS TO BE OBSERVED BY THE FIREMAN.

To avoid loss from want of oxygen the fireman must see that air is passing freely into the ash pan, that the grates and fire are kept open and that air is passing through the fire-door. Every possible effort must be made to keep the fire clean. If there is a ventilator in the door, as soon as the fire is heavy enough to prevent cold air from passing through the grates it must be opened. When there is evidence that clinker is forming on the grates the hook should be used, working the points through the fire at different places and drawing it enough to move the clinker and allow air to gain admission through the grates. The fire should be kept level without excessive shaking of the grates. Puddling and smearing the fire over with the hoe is a bad practice.

TEMPERATURE OF THE FIRE GASES.

A fire when just visibly red is at about 1,000 degrees; when bright red, at 1,650 degrees; when clear orange, nearly 2,200 degrees, and when bright and dazzling, above 2,700 degrees. Herschel invented a prism by which he separated the rays of the sun and proved them to be a combination of many colors. By the same method he proved that the flames, and their color as well, which constitute a dull red fire, exist when the fire is bright and dazzling, its condition and temperature being changed by the addition of other rays. Thus it may be seen that the color is a true indication of the condition of the fire. The last colors added are violet and ultra-violet, these last colors indicating that the process of combustion is complete. When the fire assumes the color of an arc light the fireman may know that nothing is going to waste.

IGNITING POINT—CARBON AND HYDROGEN.

Carbon ignites at about 1,650[2] degrees, hydrogen gas at 2,200[2] degrees. If the fire-box be cooled below these temperatures, a portion of the gases will be lost. Thus it will be observed that in order to consume the gases from the coal economically there must be an adequate supply of air and there must be a temperature high enough to ignite them. The ingenious fireman will soon learn to distinguish the imperfect from the perfect fire by the color alone.

[2]This is approximate, not demonstrated.

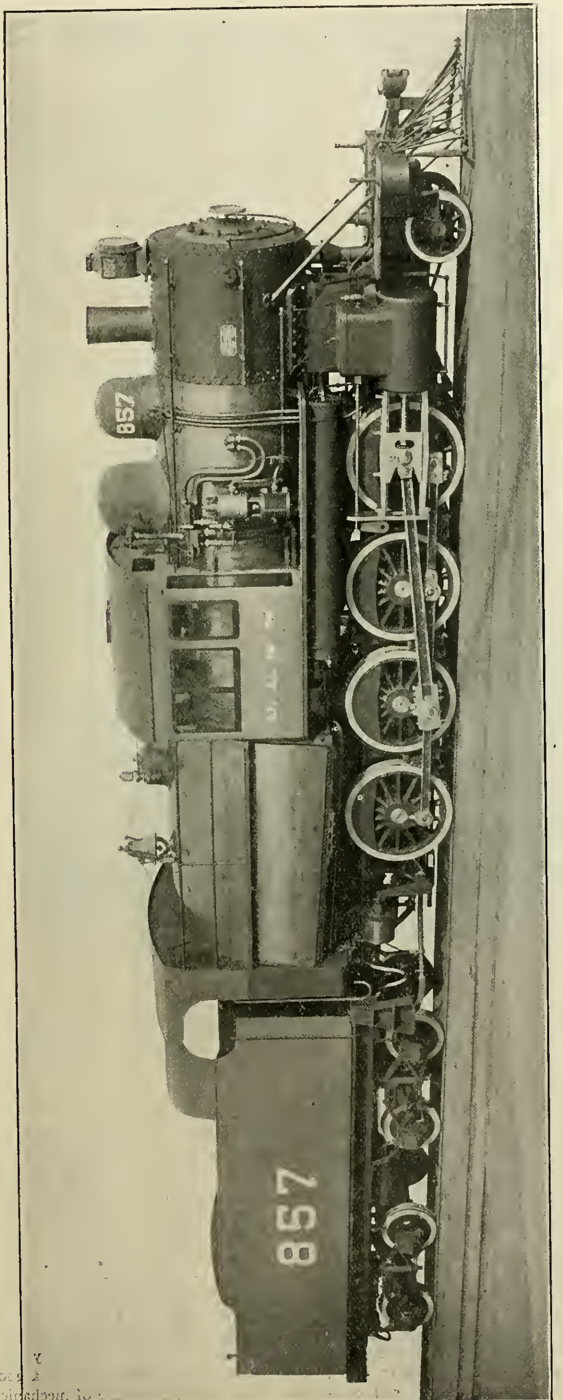
Properly Directed Industry.

People who are industrious have the best physical or mental equipment for making their way in the world; but industry to be fruitful must be guided by good judgment and common sense. We wish to warn young people that industry unless properly directed is like a boat without a rudder, for success in life to the diligent depends on what you are industrious about. If you spend all your time and strength in polishing pans or blacking your boots your industry won't carry you very high. The industrious mind in a rested body plans in an hour what brings in more money than a tin pan polisher may earn in a year. People who work only or mostly with their bodies have as good a right as the capitalist to work with their minds. The world always wants newer things, more curious things, more improved things, more amusing things. No workman in any trade, any art, any profession, should be content with doing what some one has done before him, even though he does it well. He should aim at doing something better than any one has done before him. When he can do this he must next push it on the world's notice.

Push is a talent as much as skill in any art. You can commence pushing by imagining yourself as a pusher. Keep yourself before yourself in your mind as a pusher, and such frame of mind will at length make you push. There is a power in a continual imagination of yourself in any certain character which does make you more and more like such character. Imagine that the best belongs to you and you will find the best coming to you. Imagine the worst, see yourself in the poorhouse, and the poorhouse comes to you. Success, like charity, must commence at home in the mind. If now you are compelled to live in a poor room and on poor fare, do so only under protest. Keep your mind on the better room and the better fare. Don't say, "I 'spose I must always take up with this." Say instead, "I am going to have better things than these." You are then creating for yourself strength, not weakness. You are then ever strengthening this inexplicable mental attraction which will bring these things to you.

Selection of Trainmen for Queen and Crescent System.

The Cincinnati, New Orleans & Texas Pacific Railway Company have adopted the practice of selecting firemen and brakemen from men already in the company's service. This gives the opportunity of advancement for trackmen, shop helpers, bridge laborers and others of that class. Before being accepted for what is regarded as superior positions, the men have to pass an examination to prove that they have the education required, and care is taken to see that they have the natural intelligence required for good train men. If they are accepted they are sent out for a few trips to learn the road and to become familiar with the work they are intended to perform. Before being put on the list of employees they are again examined on signals and other simple matters, which is a good test of their intelligence.



SCHENECTADY CONSOLIDATION FOR DELAWARE, LACKAWANNA & WESTERN R. R.

Delaware, Lackawanna and Western Consolidation Engine.

Our illustration of the anthracite burning consolidation engine represents a type that is in satisfactory operation on the Lackawanna. It is an engine embodying the principal features and standards so long preserved on that road. together with the modern touches which give evidence of the progressive ideas of the designer and builder in meeting the requirements of the road. The engine is designed to burn the fine anthracite coal so abundantly mined on the Lackawanna line. This requires an immense grate, 94.9 square feet, which, with the heating surface provided, 2,772.83 square feet, makes a successful and economical steamer, when the character of the fuel is considered. In this connection the accompanying description will be of interest. The engine is one of the recent productions of the Schenectady works of the American Locomotive Company, who have also built for the same railroad within the past year some heavy eight-wheel passenger engines and also some wide firebox bituminous coal burners, the latter being of the consolidation type, but somewhat lighter than the engine herewith illustrated and described.

The oblong casting under the side of firebox attracts attention along the road. It is an air blower arrangement to blow the ashes out of the "corner" left in the ash pan where the wheel cuts in underneath. The main reservoirs (two 16 by 126 inches) are under the running board and away from the firebox, which is now considered one of the best places for it. The throttle in the side of dome is proving quite a favorite in many places.

The rod packing is the United States; valves are Richardson balanced; injectors, Hancock composite; American brakes; Westinghouse 9½-inch pump; Leach sanders;. Gollwar bell ringer; Crosby gages and Consolidated safety valves are used. The main dimensions follow:

Weight in working order—186,000 lbs.

Weight on drivers—166,000 lbs.

Wheel base, driving—15 feet 10 inches.

Wheel base, rigid—15 feet 10 inches.

Wheel base, total—24 feet 8 inches.

Cylinders—21x26 inches.

Horizontal thickness of piston—5½ inches.

Diameter of piston rod—3¾ inches.

Greatest travel of slide valves—5½ inches.

Outside lap of slide valves—⅞ inch.

Diameter of driving wheels—57 inches.

Diameter and length of driving journals—9 inches and 8½ inches diameter by 12 inches.

Diameter and length of main crank pin journals—main, 6¾x6½ inches; F. & B., 5 inch diameter by 3¾ inches.

Diameter and length of side rod crank

pin journals—main side, $7\frac{1}{4}$x$5\frac{1}{8}$ inches; inter, $5\frac{1}{2}$ inches diameter by $4\frac{7}{8}$ inches.

Engine truck journals—6 inches diameter by 10 inches.

Diameter of engine truck wheels—30 inches.

Boiler, outside diameter of first ring—70 7-16 inches.

Working pressure—200 lbs.

Firebox, length—126 inches.

Firebox, width—$108\frac{1}{4}$ inches.

Tubes, number of—350.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—14 feet.

Westinghouse American combined brakes on all drivers, tender and for train; $9\frac{1}{2}$ inch R. H. air pump.

Leach sand feed, E double.

Sterlingworth Marden patent brake beams.

Gollmar bell ringer.

Crosby steam gage.

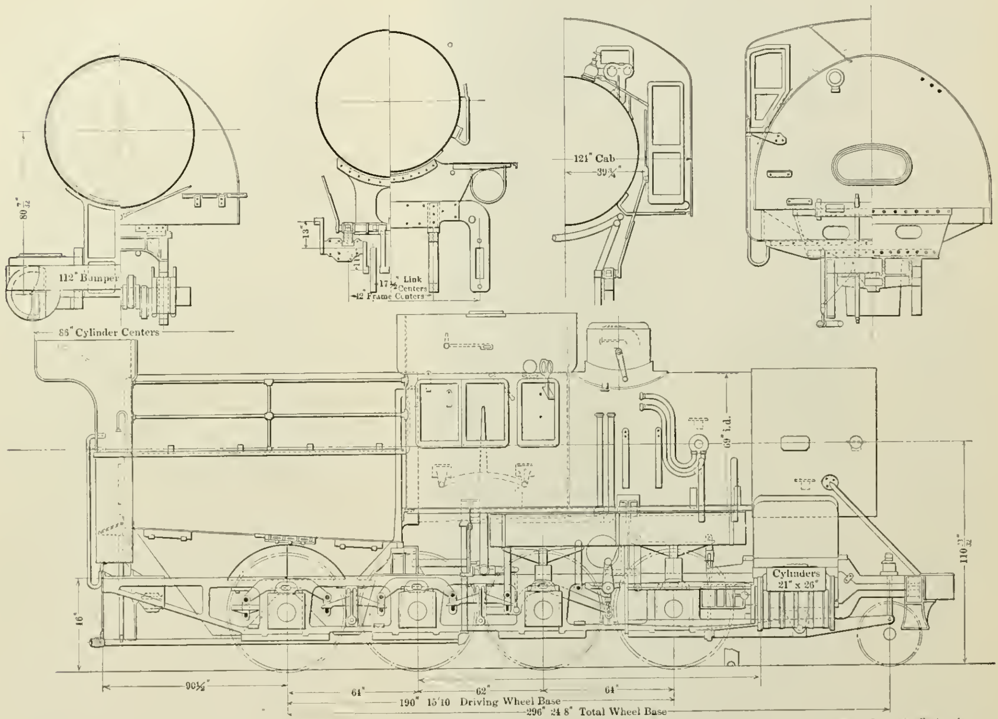
Two Consolidated safety valves; one muffled, one encased.

Court Ruling Against Common Sense.

The benefits which railroad employees enjoy under the Safety Appliance law, are beginning to be seen in court decisions in favor of persons who have been injured by cars not properly equipped with the safety appliances which the law calls for. As a rule the judges are very fair, but a case was decided lately in which the judge seemed to strain the law to favor the railroad company. A switchman was injured coupling a car to a tender, which was not equipped with an automatic coupler, and a suit was brought against the railroad company. The United States Circuit Court directed the jury to return a verdict in favor of the railroad company, on the grounds that a locomotive tender was not a car within the meaning of the act. That was contrary to common sense but it knocked out the man who was injured by the negligence of the railroad company.

President A. A. Robinson, of the Mexican Central Railroad, says that work will begin soon on the 200-mile extension of this road from Torreon to Trevenio. The last named point is near Monterey. President Robinson says furthermore that the purchase of the St. Louis, Kansas City and Colorado road by the Rock Island would be of advantage to the Mexican Central, the headquarters of which are soon to be moved to St. Louis. The annual meetings of the stockholders of this road, however, will continue to be held in Boston, as the Mexican Central is a Massachusetts corporation.

The fan illustrated and described on page 227 of the May issue was made by the Buffalo Forge Company, Buffalo, N. Y. This is only one of the many sizes and styles made by them, but gave a good idea as to the increased use of mechanical draft.



DETAILS OF THE SCHENECTADY CONSOLIDATIONS FOR THE LACKAWANNA.

Heating surface, tubes—2,548.45 square feet.

Heating surface, firebox—224.38 square feet.

Heating surface, total—2,772.83 square feet.

Weight of tender—47,700 lbs.

Wheels, diameter—33 inches.

Journals, diameter and length—5 inches diameter by 9 inches.

Wheel base—16 feet $9\frac{1}{2}$ inches.

Water capacity—6,000 U. S. gallons.

Coal capacity—10 tons.

Total wheel base of engine and tender—53 feet $4\frac{1}{2}$ inches.

Atchison, Topeka and Santa Fe Tandem Compound Consolidation.

The tandem compound consolidation engine, illustrated herewith, was built at the Rhode Island works of the American Locomotive Company for the Atchison, Topeka and Santa Fe Railroad. These engines have given very satisfactory results in the short time they have been in service, not only in tonnage hauled, but in economy of fuel and water.

Unless we are very much mistaken the Santa Fe now has more tandem compounds than any other road or in fact of all of them together. Their performance will be watched with a great deal of interest by all who are interested in compound locomotives of any kind as well as by their enemies. The tractive effort (working compound) is calculated at 40,000 pounds. Among the general dimensions are:

Weight in working order, 201,000 pounds.

Weight on drivers, 176,000 pounds.

Wheel base, driving, 15 feet 4 inches.

Wheel base, rigid, 15 feet 4 inches.

Wheel base, total, 24 feet 1 inch.

Cylinders, 16 inches and 28 inches by 32 inches.

Diameter of driving wheels, 57 inches.

Driving journals, 9½ inches by 12 inches, main, 9 inches by 12 inches, F. & B. & Int.

Diameter and length of main crank pin journals, 6¾ inches by 6¾ inches.

Diameter and length of side rod crank pin journals, F & B., 4½ inches by 4 inches, Int., 5½ inches by 4½ inches.

Engine truck journals, 6½ inches by 10½ inches.

Diameter of engine truck wheels 31¼ inches.

Diameter of boiler, 68 inches.

Working pressure, 210 pounds.

Firebox, length, 101⅛ inches.

Firebox, width, 71¼ inches.

Tubes, number of, 355.

Tubes, diameter 2 inches O. D.

Tubes, length over tube sheet, 15 feet 10 inches.

Heating surface tubes, 2,787 square feet.

Heating surface firebox, 178 square feet.

Heating surface, total, 2,965 square feet.

Grate surface, 50 square feet.

Tender weight empty, 46,400 pounds.

Wheels, diameter of, 34¼ inches.

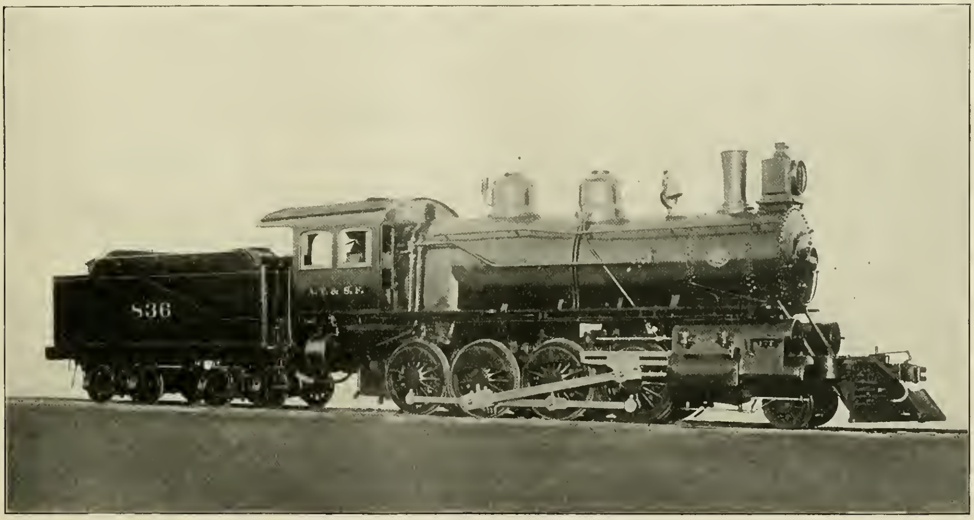
Journals, 5 inches by 9 inches.

Wheel base, 17 feet 6 inches.

Water capacity, 6,000 gallons.

Total wheel base of engine and tender, 53 feet 9½ inches.

The special equipment includes Westinghouse-American combined brake on drivers, tender and for trains; 11-inch L. H. air pump; Westinghouse engineers air signal; Le Chatelier water brake on cylinders; Sander, Leaches D-2; brake beams, Monarch; Westinghouse friction draft gear, Crosby steam gage, 6¾ inches face; three 3-inch Crosby pop safety valves. simplex injectors.



SANTA FE COMPOUND BUILT BY RHODE ISLAND WORKS OF AMERICAN LOCOMOTIVE COMPANY.

Mr. H. S. Peters has recently received several orders for overalls from Great Britain and other foreign countries. The experiences with these overalls are likely to create a lively discussion. Mr. Peters thinks RAILWAY AND LOCOMOTIVE ENGINEERING had something to do with his receiving the orders.

The Advantages of An Oil-Burning Locomotive.

BY G. B. VON BODEN, MECHANICAL DRAFTSMAN, S. P. CO.

In the past few years oil as fuel for locomotives has been brought forward with great rapidity. Owing to its economy and satisfactory service a number of railroads on the Pacific slope have been using oil as fuel quite extensively.

In burning oil it is very important that the volatile gases should be properly consumed before they leave the fire box, as they contain high heat producing qualities. The average bituminous coal contains about 25 per cent hydro-carbons, and about 65 per cent. carbon. About 16 per cent. of the hydro-carbons is hydrogen gas which makes the hottest fire that is obtainable. As a very high temperature is required to burn this gas, it is essential to have an even temperature in all parts of the fire box. When such is not the case, the oil passes away unconsumed in the form of smoke, thereby causing an unnecessary waste of oil. Philips states in the *Engineer Chemistry* that the perfect combustion of one pound of crude oil produces 20,260 heat units. One pound of first-class coal produces about 15,000 heat units. This merely shows how important it is to have all the gases consumed and to have an igniting temperature in all parts of the fire box.

To obtain these results it is first necessary to have a good hydro-carbon burner. The Southern Pacific Company for locomotive practice has adopted a simple form of burners that gives no complications. "The Sheedy and Carrick Gravity Burn-

er," which was illustrated on page 300 of Railway and Locomotive Engineering last year.

Owing to the constantly varying condition of a locomotive when in service, practical experience with oil burning locomotives, has demonstrated the fact that the more "Complete Atomizers" have failed to supply the required amount of oil when most in demand. The permanent success of the oil burning locomotive depends upon the method of the introduction of large quantities of oil through the burners when large quantities are needed.

It is the practice of the Southern Pacific to chain-gang their engines, or in other words, to run them by the pool system, and, as it is desirable to obtain the most economical results for oil burning locomotives, in the equipping of the same, simplicity should be adhered to. From recent tests made from the "Witt Pressure," and the "Sheedy and Carrick Gravity Oil Burner" which were taken on the Los Angeles Division from Engines No. 1,722 and 1,723; with the Vanderbilt Corrugated Fire Box, the following results were obtained:

Pounds of water evaporated from and at 212 degrees, Witt 11.86 and Sheedy 14.10, ton miles per gallon of oil, Witt 64.16, Sheedy 92.85. Gain in efficiency of the S. P. burner over Witt burner 15.8 per cent.

It has generally been the practice in equipping oil locomotives to eliminate the grates and to substitute them by building a pan called the inner pan. On account of the necessity for draft appliances it has become the practice to admit air under the arch and under the mouth of the burner through air cavities cut in the floor of the inner pan. As the draft appliances have much to do with successful conditions, it has been found from recent experiments made on the Western Division, that a grate with two rows of oblong openings has proven more satisfactory than air cavities. It has eliminated the drumming and explosions that had been experienced in the past.

With the latest arrangement of fire boxes for burning oil the grates are placed on the old grate bar bearings, serving to support the side walls and arches. These grates are covered with fire brick except where the air is admitted under the arch. The air being admitted through these grates, mingles with the oil and serves to complete the combustion most effectually. It will be noticed that the fire box is bricked up all around the sides and ends to about the height of the arch. In cases where the fire box is 7 feet or more in length, the front wall is constructed at a distance not over 72 inches from the boiler head. The object of this is to restrain the flame and maintain an even temperature in all parts of the fire box.

The brick work is so arranged as to maintain an even temperature, and, therefore, there would be no necessity for containing a deflective plate or a petticoat pipe.

The capacity of the oil tanks is from 2,000 to 3,500 gallons. At present there are two different methods of heating oil in these tanks. One is the direct heater, or in other words, the heating of oil by live steam. This method of heating is very rapid. heating oil to 140 per cent. F. or still higher. But the temperature should not exceed 90 per cent. F. or blood heat. The only drawback to this method of heating is that often times improper handling accumulates considerable water in the oil.

The method I would recommend for heating oil is by steam coils. There are cases, I will admit, where the coils have failed to heat the oil to a temperature that would cause it to flow freely. But in my estimation if there are a sufficient number of coils placed in the bottom of the tank, coiled around the oil supply valve, no water could be admitted into the oil. Furthermore, after the oil is heated to a temperature of 90 degrees, the globe valve which controls the supply of steam to the coils should then be cut down to less than quarter of a turn, thus supplying a continuous amount of steam to the coils, and keeping the oil at an even temperature.

Oil is conveyed from the tender to the burner by a pipe and hose, similar to those used for injectors, with the exception that they are an inch and a quarter in diameter.

At times it is desirable to have a very small supply of oil for the burner, especially when standing at stations, or drifting down grades. In order to accomplish this the passage way through the valve, regulating the supply, is made diamond shape.

The levers for operating and adjusting the burner, oil supply, and steam jet should be placed inside the cab, and conveniently near the fireman's seat box, that he may remain seated. This enables him to watch for signals on the line, and observe closely the movements of the engineer adjusting the oil supply accordingly.

The use of oil is certainly an improvement on the coal burning system. If carefully fired the burning of oil results in no smoke or sparks, laborious terminal work, such as cleaning fires, hauling away ashes, and loading coal, which is quite an item on most roads, is not experienced with an oil burning locomotive.

This labor in some cases amounts to 50 cents for each ton of coal burned and should be taken into consideration when comparing cost between coal and oil.

Another great advantage is that the locomotive is always ready for service, that the fire is always clean and therefore, there is no danger of its being torn up by heavy exhausting or slipping on the engine.

(Illustrations of the oil burning system described by our correspondent appeared on page 300 of Railway and Locomotive Engineering last year and they have been reproduced in our book Care and Management of Locomotive Boilers, by Henry Raps.—Ed.)

Westinghouse steam turbines are to be adopted in the electric generating station to be built for the Metropolitan Railway Company, of London, the contract having just been given to the British Westinghouse Electric & Mfg. Co., of Manchester. The latter are now filling a similar contract for the Metropolitan District Electric Traction Company, and as there will be a general similarity in the two stations, it will be easy to arrange for connecting the two and making them interchangeable, as far as the supply of current is concerned, which feature was required by the terms of the franchises of the two roads. The Metropolitan power station will be located at Neasden, in the northwest of London, and will contain three sets of 3,500 kilowatts capacity each. The Chelsea station of the Metropolitan District Railway will contain four sets of 5,000 kilowatts each. The electrical machinery for both stations will also be supplied by the Westinghouse Company. The current will be three-phase alternating and of 10,000 volts, to be transformed in substations to direct current for use in the car motors.

The Delaware, Lackawanna & Western Railroad, through Chief Engineer W. K. McFarland, has awarded the Union Switch & Signal Company of Swissvale, Pa., and order for 125 Union Electric 2-arm Semaphore Signals, Relays and other material, for the equipment of 40 miles of double track with Automatic Block Signals. This order was placed upon the recommendation of Signal Engineer A. H. Rudd and is the third large order placed with the Union Switch & Signal Company for this type of signal, of which 286 are now in use on the D., L. & W.

Some rather amusing improvements have been made on locomotives by people who could only see one thing at a time. Not long ago a master mechanic conceived the idea of putting a pony truck under the firebox of a locomotive that was too heavy behind. His first difficulty was with the ash-pan. After infinite scheming he got in the truck and then could not get up the ash-pan. The truck was moved from under and an ash-pan planned that went into place, but the truck had to be removed every time the ash-pan had to be taken down.

Messrs. B. M. Jones & Co., the well-known representatives of the best English iron and steel, have removed to 159 Devonshire street, Boston, Mass., where they will be glad to see their friends and business acquaintances.

Of Personal Interest.

Mr. Garret Vliet, assistant master mechanic of the Grand Trunk Railway, has been transferred from Gorham to Portland, and will have supervision of all the motive power interests at that point. Gorham station will, in future, be subsidiary to Portland and under the jurisdiction of Mr. Vliet.

The office of general master mechanic of the Gulf, Colorado & Santa Fe Railway has been abolished and Mr. Jas. McDonough assigned to other duties.

Mr. Dennis Brown, formerly general foreman for the Cincinnati, New Orleans & Texas Pacific Railway at Somerset, Ky., has resigned to accept a position as master mechanic for the Southern Railway at Princeton, Ind. Mr. Brown left a good many friends, as was fittingly shown by presenting him with a nice silver set.

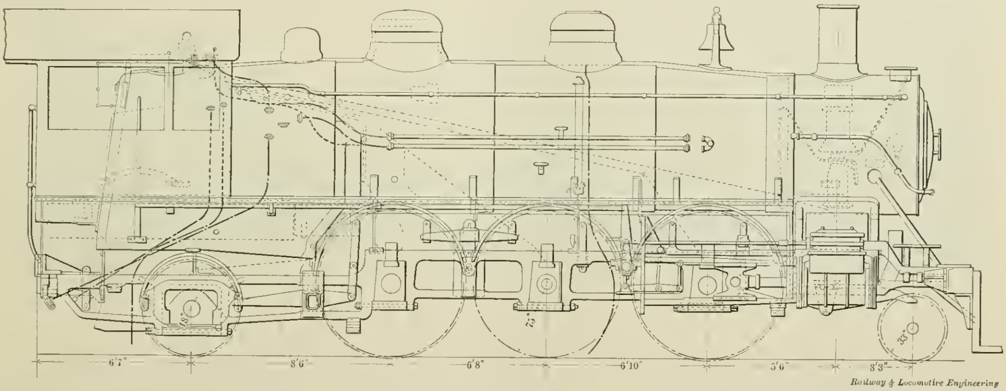
Mr. C. E. Vorhis, train master of the Cincinnati division, will become superintendent of the Wellston division. Mr. S. B. Floeter, superintendent of the D. & M. division, will also hold the same position on the F. Ft. W. & Western division. Mr. W. C. Shoemaker will be promoted from assistant superintendent of the D. & M. division to the position of superintendent of the Cincinnati, Hamilton and Indianapolis division with headquarters at Connersville, Ind.

Mr. A. J. Cunningham, formerly general foreman of the Chicago and Western Indiana and Belt Railway, has been appointed erecting shop foreman of the Central Railroad of New Jersey at Jersey City, N. J.

Mr. J. Schilling, formerly with the Wabash, has been appointed division master mechanic of the fourth division of the Denver and Rio Grande at Alamosa, Col., to succeed Mr. G. H. Shone, resigned.

Mr. S. T. Park has been appointed division master mechanic of the Southern California Railway at San Bernardino, Cal., to take the place of C. F. Lape, resigned. Mr. Park was formerly master mechanic of the Santa Fe Pacific at Winslow, Ariz.

Mr. J. A. Davis has resigned the position of division superintendent of the Missouri, Kansas and Texas at Parsons, Kan., to become superintendent of the Iowa Central, with headquarters at Oskaloosa, Iowa.



DETAILS OF ILLINOIS CENTRAL PRAIRIE TYPE

Mr. C. W. Huntington has been appointed general superintendent of the Central Railroad of New Jersey, vice Mr. W. W. Wentz, Jr., resigned.

Mr. A. Galloway, superintendent of the Cincinnati and the Cincinnati, Hamilton and Indianapolis divisions of the Cincinnati, Hamilton and Dayton Railway, has resigned. He will not engage in railroad work at present but will go to the Pacific coast for a much needed rest. He may return to railroad life later. His resignation will make the following changes: J. A. Gordon, formerly superintendent of the Wellston division, will become superintendent of the Cincinnati division, which division has been extended from Cincinnati to Lima instead of from Cincinnati to Dayton; headquarters Dayton, Ohio.

Mr. R. A. Dugan, assistant to the president of the Elgin, Joliet and Eastern, has resigned to accept a position with the Southern Railway.

Mr. F. S. Hunt has accepted the position of division engineer on the New York Central and Hudson River Railroad. He was formerly chief engineer of the St. Joseph and Grand Island Railway.

Mr. Wm. B. Hoeck, roundhouse foreman of the Atchison, Topeka and Santa Fe Railway at Topeka, Kan., has been appointed general foreman of the Fort Worth and Denver shops at Fort Worth, Texas.

Mr. Chas. Wincheck has been appointed master mechanic of the Mexican Central Railway at Aguas Calientes, Mexico. He was formerly general foreman of the locomotive department of the Santa Fe Pacific at Albuquerque, New Mexico.

Mr. W. F. Eberle, general car inspector of the Pennsylvania Railroad at Altoona, Pa., has been appointed assistant general foreman of the car shops of that road with office at same place. Mr. Eberle has been with the Pennsylvania since 1875.

Mr. P. M. Crosby has been appointed general foreman of the Chicago Great Western Railway at Oelwein, Iowa.

Mr. H. A. Fergusson has been appointed assistant superintendent of motive power of the Chicago Great Western Railway with headquarters at St. Paul, Minn.

Mr. W. E. Symons, so well known through the work he did in reorganizing the motive power department of the Plant System, has left there and taken a position of mechanical superintendent of the Gulf, Colorado and Santa Fe Railway at Cleburne, Texas.

Mr. W. J. Hartman, the well known air brake expert, has resigned his position on the Monon Route and accepted the position of air brake instructor of the Chicago, Rock Island and Pacific Railway with headquarters at the Chicago shops.

Mr. Andrew Gibson has been advanced from the position of assistant engineer on the Northern Pacific to that of division superintendent. Mr. Gibson is a native of Scotland and has been with the Northern Pacific for nineteen years.

Mr. G. J. Bury has been promoted from assistant general superintendent to be general superintendent of the Canadian Pacific Railway with headquarters at North Bay.

Mr. J. R. Michaels has been appointed superintendent of the Tennessee Central. He began his railway work in the West as telegraph operator and rose to be train dispatcher. He was superintendent of telegraphs on the Northern Pacific for several years and left there to go to the Tennessee Central.

Mr. C. W. Spencer, general superintendent of the Lake Superior divisions of the Canadian Pacific Railway, has been appointed vice-president and general manager of the Pontiac Pacific Junction.

Edward B. Clark, superintendent of the Pittsburg plant of the American Locomotive Company, has resigned to become superintendent of the Rogers locomotive works at Paterson, N. J. J. R. Howgate, assistant superintendent of the Schenectady plant, will become superintendent of the Pittsburg works.

Mr. E. E. Snyder, at present superintendent of the Memphis division of the Louisville & Nashville Railroad, has been promoted to be superintendent of the First division, with headquarters in Louisville, succeeding Mr. Daniel Breck. Mr. Breck goes to St. Louis, as superintendent of the Terminal Association at that point. Mr. F. N. Fisher, now train master on the Memphis division, will become superintendent of that division, succeeding Mr. Snyder. The latter has been with the L. & N. for many years and is a valuable traffic man.

Mr. David Meadows has been appointed road foreman of engines of the Canada Southern Division of the Michigan Central Railroad, with headquarters at St. Thomas, Ont.

Mr. M. S. Monroe has been appointed master mechanic of the Macon, Dublin & Savannah Railroad Company, with headquarters at Macon, Ga.

Mr. Frank Bell has been appointed assistant superintendent of the Dakota Division of the Great Northern Railway, with headquarters at Larimore, North Dakota, vice Mr. W. H. Hill, resigned.

Mr. Arthur M. Sharpe has been appointed acting superintendent of the Minnesota Division of the Minneapolis, St. Paul & Sault Ste Marie Railway with office at Enderlin, N. D., vice Mr. C. P. Eckles, resigned to accept service elsewhere.

Mr. S. A. Walker has been appointed assistant superintendent of the Montana Division of the Great Northern Railway, with headquarters at Havre, Montana, vice Mr. Frank Bell transferred.

Mr. E. D. Sewall has been appointed assistant general superintendent of the Chicago, Milwaukee & St. Paul Railway, with office at Minneapolis, vice C. A. Cosgrave, resigned.

Mr. Jacob N. Barr, the well known superintendent of motive power, has left the Erie Railroad to become general superintendent of the Chicago, Milwaukee and St. Paul. Mr. Barr's strong point is organization in which line he has displayed masterly ability in all the positions he has filled. We anticipate that he will make as much of a success in the larger field he is about to enter, as he has achieved in the mechanical department, which is saying a great deal. Another strong attribute possessed by Mr. Barr is his success in handling men. The policy he has always followed was to keep in touch with the men under him and inspire them with the confidence that their interests are safe in his hands. Harmony and good feeling are sure to prevail where Mr. Barr holds the helm.

Mr. W. S. Morris, for the last ten years superintendent of motive power of the Chesapeake & Ohio Railway, has resigned to accept the position of mechanical superintendent of the Erie Railroad just vacated by Mr. J. N. Barr. Mr. Morris has enjoyed a course of experience and training that makes him eminently fitted for the difficult duties he has undertaken to perform. In some respects his experience has been ideal, and his training all that could be desired to enable him to manage the mechanical department of a great railroad system in a way that will satisfy the company and promote the efficiency of the mass of men under his charge. The foundation of his training was the old fashioned apprenticeship in a machine shop, his leisure time being devoted to learning mechanical drawing and to the study of engineering science. It has been from such youths that our most successful railroad officials have risen. The steps that he rose by were machinist, locomotive fireman, locomotive engineer, shop foreman, assistant master mechanic, master mechanic, the latter position having been filled on several railroads, making good training for superintendent of motive power. A friend, talking lately about the career of Mr. Morris, remarked that he was a first-class man in every occupation he worked at. There is not an operation performed in his department that he cannot tell from his own knowledge if it is well done or otherwise. Besides having the valuable equipment of his experience, Mr. Morris is an excellent executive officer and a popular leader of men. He is a past president of the Railway Master Mechanics' Association and high up in the councils of the Master Car Builders' Association.

Mr. C. A. Seley has been appointed mechanical engineer of the Chicago, Rock Island and Pacific Railway, with headquarters at Chicago. He will have charge of the drawings and laboratory tests and will perform the duties usually assigned to mechanical engineers. Mr. Seley is one of the most successful mechanical engineers in the country and is recognized as an excellent authority on the designing of all railway machinery. He is remarkably well posted on steel cars and his experience on the Norfolk and Western has given him an excellent opportunity to watch the weak points which have developed in steel car construction. Mr. Seley has been an occasional contributor to RAILWAY AND LOCOMOTIVE ENGINEERING, and his writings are in high favor with the scientific part of our readers.

An office has been opened by Clarence P. Day at 140 Nassau street, New York city, where he carries on the business of advising counselor. His plan is to give advise to advertisers concerning the best mediums for reaching customers. The advertiser defrays the expense of obtaining counsel with the result that the very best mediums for advertising are recommended instead of those that will pay the greatest commission as is the general case with advertising agencies. Among recent customers obtained by Mr. Day is the Tabor Manufacturing Company, of Philadelphia.

The City Electric Railroad Company, of Kief, has lately received two Pullman cars, which were ordered by the municipality as an experiment. The cars were shipped from Berlin in separate parts and are now being put together at the Kief City Railroad Works. They are of the double-truck type and have four electromotors of 25 horsepower each. The cars at present in use at Kief have two motors of 25 horsepower each. The new cars are equipped with all the latest improvements, including electric brakes and electric lights.

"The New Cuban Railroad."

BY WALDON FAWCETT.

The project now being carried out by Sir William Van Horne and his associates for the construction of a complete railroad system throughout the length of the island of Cuba constitutes one of the most interesting and most daring railway ventures which has been presented in many years. The new system will embrace, all told, some four hundred miles of track between Santiago and the Port of Nipe in the province of Santa Clara, and it is claimed that in influence upon industrial, agricultural and commercial development the new transportation system will be entitled to rank with the trans-continental railroads of the United States, the Trans-Siberian Railroad of Asia and the Cape to Cairo Railroad of Africa.

The present railway system of Cuba is entirely inadequate in bringing the extreme ends of the island together, Santiago and Havana being as far apart, in point of time, as New York and San Francisco, though separated by a gap of little more than three hundred miles. To remedy this defect is the object of the new Cuban railway, and it is doubtful if any other one enterprise will prove of such vast benefit to the island. Indeed, it is declared that no revolution could have existed in Cuba had such a railway been completed by the Spanish government. Not only will the possibility of future political turbulence be in a great measure eliminated and the entire island opened to commerce, but land now unproductive and of practically no value will be worked. Moreover, the seaport towns will experience a wonderful impetus in their trade relations for it is proposed to construct numerous branches extending from the trunk line to the seaboard.

From the standpoint of railroad interests generally, however, perhaps the most interesting phase of the Cuban railway project is found in the peculiar obstacles which it has been necessary to overcome in its construction. Sir William Van Horne had already organized a company with a capital in the neighborhood of $10,000,000 when owing to the scandals growing out of attempted "franchise grabbing" on the island the United States Congress passed what is known as the "Foraker Resolution" prohibiting the temporary government of Cuba from granting any rights, concessions or franchises. So strictly was this resolution enforced that even the right to extend existing railways was refused, and it appeared at the outset as though any new enterprise which would find it necessary to use the public highways or even to cross them would be effectually blocked. However, Sir William Van Horne did not propose to allow his enterprise to be balked, and therefore inaugurated a new method of railroad building, namely, construction work without governmental sanction.

As a first step heavy purchases were made of land in the districts through which it was sought to carry the line. After the private right of way had thus been secured the line of the road was surveyed and graded and stations were erected at convenient points on the property owned by the company. All this was in strict accordance with the rights of the corporation as a land owner, for there are over a hundred private railways on the large plantations of Cuba. Under this plan of construction no attempt was made to cross the public highways, and thus there were breaks in the railway line at every point of intersection with a public road.

Finally when the enterprise had progressed sufficiently far to afford a clear indication of its character Sir William and his associates presented the case to the Military Governor of Cuba, and he, after giving careful consideration to the matter, granted what are known as "revocable licenses" for crossing public roads which give promise that the military government will not interfere with the undertaking. Without this daring procedure the completion of the Cuban railway would assuredly have been delayed for several years. As it is the company has had about three thousand men at work from the time of the commencement of active operations, employing them in grading, building bridges and track-laying, and after the harvest of the sugar crop the force was increased to upward of six thousand men.

The construction of the line has, because of the peculiar mountainous character of the country, presented many difficulties. Moreover, it has been necessary to devote exceptional care to the construction of bridges and tracks in order to provide against the rainy seasons of this tropical climate when water in torrents descends upon the roadbeds. The main line of the Cuban Railway will probably be completed in May or June, 1902. It is between three hundred and fifty and four hundred miles in length, extending from Santa Clara to Santiago, and is in every respect a first-class line, equal in all respects to the average line in the United States. The bridges, of which there are a great number owing to the volume of water which falls in the rainy season, are of steel construction, and the rolling stock and equipment are thoroughly up to date.

It is planned to construct as feeders to the main line feeders to the north and south coasts which will reach the ports of Nipe, Gibara, Baracoa, Sancti Spiritus, Santa Cruz del Sur and Manzanillo. These branches will bring the aggregate length of the entire system to the neighborhood of one thousand miles. The connection at the City of Santa Clara, with the western system of railroads of the island, is most important, enabling a passenger to go by rail the entire length of the island, from Pinar del Rio, the capital of the westernmost province, to Santiago, the capital of the easternmost province. In this connection it may be noted that the officers of the Western Havana and Cuban Central Railways, two of the

Grading for 20th mile. Culvert at Station 1548.

VIEWS ON EASTERN DIVISION OF NEW CUBAN RAILWAY.

most important of the existing lines on the island, have looked with such favor on the Van Horne project that they are understood to have given financial support to the new project.

As having a direct bearing upon the field in which this new railroad enterprise is to operate, it may not be amiss to give a momentary glance to the public railways already in operation in Cuba.

STEEL SPAN AND TRESTLE WORK, EASTERN DIVISION.

There are on the island seventeen separate systems of an aggregate length of 1,225 miles, although nearly all of these lines have their ownership vested in five companies, which between them practically control the transportation situation on the island. The longest single system has a length of 417 miles. The cost of these seventeen systems has been somewhat in excess of $57,000,000, and the earnings amount to $6,212,000. Three of the systems each show earnings in excess of $1,000,000, and in the case of one system, the United Railways of Havana, the earnings exceed $1,500,000.

The new Cuban Railroad is but one step in the enterprise which Sir William Van Horne and his associates have evolved for the development of the natural resources of Cuba. Vast tracts of land have been purchased in the central and eastern provinces, including forests, pastures and first-class agricultural land. Upon these tracts it is proposed to establish colonies, giving the preference in every case to the best men in the construction gangs. During the construction of the road the Van Horne syndicate has erected a number of saw mills in the timber areas for the purpose of getting out logs and lumber and ties for the use of the road, and as soon as the work of construction is completed it is proposed to turn these saw mills into private hands and organize companies to cut the timber for commercial purposes. The Van Horne company is also encouraging immigration from Spain, the Canary Islands, Central and South American countries, and if the effect of the climate is not found to be injurious to Americans, colonies from the United States will be taken to Cuba.

ANOTHER BRIDGE ON THE EASTERN DIVISION.

A correspondent sends an account of a "wild run by a mad engineer" who ran his train 50 miles without a stop, passing stations at top speed, etc. If the fireman could do nothing, as stated, we fail to see why the conductor or a brakeman could not have discovered this speed with the conductor's valve in any car. An application of air in this way will cure any case of this kind in short order.

Air Line Griefs.

BY A. SUP. LYMAN.

Second Paper.

The "old man" had been in the little office an hour, just long enough to glance at a stack of 653 reports: record of yesterday's failures and only half way devour the last of a continued string of complaints that the superintendent had sent in, when he jumped up and, kicked the dog.

If anyone else had as much as intimated that the dog deserved kicking there would have been a row. Why, those two big fellows that wore the old man's name and called his wife "ma" brought that pup home; they were running on the branch now and the dog was, "ma's."

Things had not been running in the old smooth way on the Air Line, business had picked up at an alarming rate, at least to the men who were expected to handle it, the power once adequate was spread, like butter on church sandwiches, over too much territory, trying to operate two thousand miles of road with just about engines enough for one thousand, the new P. A. had cornered the slack coal market, the departments had found it necessary to "make" a great many new men. You can put a fireman on the turn table and make an engineer out of him but like other jobs they need a little breaking in. The few that came along for jobs were not of the best, and when the hours over the division reached sixteen to twenty-four the crews began to ask for "eight hours" where they had formerly doubled back, and the next blow was the one that killed father, that was the "old man"—they pooled the engines.

Had it to do, that bright clever lot of freight grabbers that Smith, the general freight agent, brought over with him had

by reason of superior ability, several "annuals," and a liberal expense account taken most of the Central's fruit, stock, and rush merchandise business, and that on top of a heavy grain movement kept things up in the air. Most of the rush biz was contracted for on basis of time delivery, and as the boys all carried Pullman's paste boards, and private cars are generally tied to rear ends, they saw more of the G. M. than motive power men have time to do and they poured their tale of woe into his ear on all occasions. The G. M. knew that they didn't make better motive power men than Barker was; he could turn out an engine for freight service, a ten wheeler with fifty-inch wheel center that could make up ten minutes on the flyer her second trip, and not sweat a hair doing it as Hogan was often heard to say. The old man was a doctor of the old school, had his peculiarities, felt privileged to scorch his own men, but would not stand for anyone else criticising them, and they liked him, swore by him even as he swore at them. His roasts the men took quietly, knew that was the end of it save that it was considered good policy to brace up if bracing was needed.

Things had about reached a climax that morning; every foreman on the job from McAdams, of the round-house, who was a stem winder, to LeClare, of the boiler shop, had worked and slaved night and day to keep things moving, but still the 653's and superintendent's kicks piled higher and higher. The old man could have quit, he was comfortably fixed; but to a man whose life had been as active as had been Barker's the thought of idleness was a nightmare, besides it would look like confessing that the game was too tough, early in life, very early, the old man might have prayed, but he never confessed. To add to this particular morning's troubles his best engineer Olson, the Swede, had been ordered off, overlooked an orange train running on special schedule, the despatcher dropped the board in front of the "fruit" so there was no inquest, but if anything hurt the "old man" it was to have a good man walk the plank. The despatcher who saved the day wore his unsought laurel wreath modestly a few days, until the episode was swallowed up by later happenings.

TWO CULVERTS ON THE EASTERN DIVISION, CUBAN RAILWAY.

SCRAPER WORK ON THE WESTERN DIVISION.

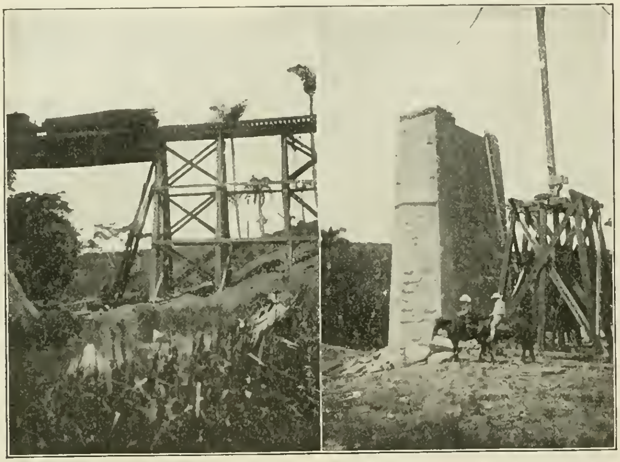
There was nothing said about this train's schedule being put out to the Swede seven hours before he met it, nothing said about the Swede receiving twenty-nine orders subsequent to the schedule, no mention of the fact that his fireman was making his first trip, had only been a student two trips, that Olson always helped new men out, no mention of a hot main pin, of a pair of injectors that took all of one man's skill to keep working, he forgot the orange train and his fifteen years of flawless service was forgotten, of course he made a splendid example, alas the human family won't follow good examples. The despatcher was a good man, competent, generous and deeply sorry for the Swede, he knew something of Olson's trials, working two districts, each heavy enough for a man, he was compelled to take short cuts in order to keep things moving at all. By having the terminal operators copy 'leven and trace the rest he saved much time, caught a few more O. S.'s in that way, of course it put the schedules a long way in advance of some trains; but self defense is the first law of nature. anyway the Swede that knew his engine like the voice of his wife, and never made mistakes in reporting work, was sacrificed.

About the time that the dog began to resume confidence in the administration some one came up the steps, whistling like a supply man who had just "placed," say about fifty squirts, squirts that deserve good branch pipes. As the old man suspected it proved to be Turner. He was a frequent visitor at the old man's office, a welcome one, the old man liked the younger one's confident style, not fresh, just seemed to know his business, always pleasant, willing to put on a suit of overclothes any time for a couple of days, or nights for that matter, most things happen in the night, if by so doing he could help out his own or employer's friends, he straightened out the old man's compound complications years before, the engineers were not overly prejudiced in their favor then but he won them over by just taking hold and doing the act, most of the human family respect

the man who does things rather than people.

Turner had barely time to say "Good morning, Mr. Barker, have a good cigar" when the gentleman addressed gasped "Where in thunder have you been? I've wanted to lean on you for a week, I'm up against the real thing and she's getting hotter every day," with that he mopped his head and fell into a chair.

"Well I put Tom down for three dozen number seven's for his little Bloods this morning; what's your trouble, asked to resign or what?"



One of the Bridges. Pier at Guaninicum River.

BRIDGE WORK ON THE EASTERN DIVISION.

"Resign the devil" replied the old man, "they wouldn't accept it unless it was made in copying ink on a 653, that's all the literature that's current now, got two hundred engineers and conductors working overtime on them; what's the trouble? here look over this mess while I go after LeClaire and his gang about the new Brooks, five of them mud burnt in less than ninety days, if that stack is not enough you will find, several thousand in the lower drawers."

WORK TRAIN AND INSPECTION CAR.

Turner did not trouble himself to look over the old man's hard luck reports, he had heard enough of the trouble in advance to size up the situation fairly well; the experience of the Air Line was that of the Belt, the High Line and other neighboring roads, perhaps a trifle worse, but the same disease, and as the young man had an honest liking for the old man he made up his mind in an instant to help him out, if asked. When the old man had returned from "stirring up the animals" as he called it, he found Turner taking things easy in the office chair, the throne, some of the boys called it, his feet resting comfortably on the much-cursed stack of "failures."

"Did you look at that mess" the old man asked; "you are too infernal lazy to even guess at the number" he continued; "they went up to seventy-three last week, there's the list, the worst of it is that the bill is a true one." Turner relit his cigar and read:

MR. THOS. BARKER, M.M.:

Dear Sir:—Attached you will find a recapitulation of engine failures on Middle division for week ending March 17.

You will note that our failures are on the increase, although they reached alarming proportions some time ago. I am of the opinion that this is a matter that should receive your closest attention, there certainly should be some end to this "no steam" question. Respectfully yours,

T. H. WILLIAMS, Supt.

No steam, set out train and returned to terminal	33
Flues, side sheets cracked and mud ring leaking......	16
Air pump failures (constituti g engine failure)	7
Broken valve yoke, eccentric straps, cut valve..	3
Piston broken in crosshead........................	2
Dirty fire, unable to clean it on road.	7
Miscellaneous.	5
Total......	73

"What do you think of that?" shrieked the old man, "about eight per cent. honest failures, no wonder you fellows rather sell supplies than take a preliminary course in hell," he continued. "Size up that thing, those new Schenectady's are gagged now with five-inch tips, bridges a half inch thick in most of them, they howled with steam a year ago on straight 5¼ tips, it was a hanging offence to bridge a nozzle then, now they walk up to the book and report "larger bridge put in nozzle." Now, take those pump failures, first class pumps not ninety days old, some of them, do you hear that one out there now?" the 516 was on the cinder pit, the groans of both air and steam end rising above the roar of a half dozen blowers; "it seems as if every man on the job has laid down except the fiend that edits those infernal reports."

When the old man's breath was spent the supply man ceased smiling and said: "you remember old man Roberts that pulled one and two opposite dad, Sallie Roberts' pa? I was a kid calling crews, you were doing the round house work then, well Sallie always rode down to the depot when her pa took one out. I used to go down on the engine myself occasionally, there was a cardboard motto worked by Sallie in the 29's cab, Roberts suggested the motto, his favorite one, "refuse to get excited" was the whole thing, I have tried to keep that idea in mind myself, perhaps on Sallie's account, don't you think it a good one? If you don't mind I will hang around a week or so and size up the situation, the office won't expect to hear from me for a week or so." "Do," said the master mechanic, "take the whole place if you want it, and say, confidentially, if you will kill that young cub of a trainmaster I will leave you all I've got." "I've a better plan for caring for trainmasters," replied Turner, "I'll take them into full partnership and together we will try to make stockholders out of a few of your engineers, yes take in some conductors, too, preferred stock if they insist on it. I will be around after dinner, don't forget Sallie Roberts' card-

board motto, she was a little peach, you remember that dude timekeeper, she married him, last time I went home they had two small timekeepers, double header, one wears pants, stout chunky cuss, built like a Pittsy consolidation, the other a girl, a sixteen-inch eight-wheeler, trim and neat, brass bands, built for a two-car branch run, looked like Sallie did fifteen years ago."

The old man followed Turner out toward the cinder path that led to the street, there seemed to be something he wished to say to the young fellow. Instead the supply man keenly sensitive to the trials of his old friend anticipated what was coming.

"Mr. Barker," he said, "if every man would do his part in times like this instead of laying down and trying to unload on someone else things would soon straighten themselves out. That applies to every man from general manager to those laborers of yours over there;" before the master mechanic could make reply he continued:

"I heard a good one on that new engineer of yours, you know who I mean, that big fellow off the Western, it seems as if he had a hard time of it with firemen, hits 'em too hard for some of the boys, so much so that they hold occasional curbstone inquests on his remains, the body absent. Some of the boys filled up a student about ready for graduation with horrible tales of the way that Murphy hit them, done it all with the reverse lever, too. The student made up his mind to watch the handling of that lever if he went out with the hard hitter. Sure enough he got his first trip with the bad man and then and there resolved to call the first suspicious move. When the engineer got his train under headway and reached for the lever to hook the links up the reformer suddenly dropped the scoop and bracing up to the engineer said: "Here, I've heard all about you and your getting students' hide, you can just put that thing back where you got it or I unload, you can't do me up." The reverse lever went back towards the corner suddenly, while pausing to reflect, and incidentally blow up, two miles farther on the engineer took a lesson in mutual forbearance, while the fireman was given a rudimentary lesson in valve motion. The "old man" was laughing immoderately when the supply man said "good bye, you will hear from us in a few days."

Details of troubles and the aids given to effect remedies will be given in subsequent papers.

A New Air Hardening Steel.

Messrs. Jonas & Colver, Ltd., Sheffield, England, have lately placed upon the market a remarkable high speed steel called Novo air steel, which is not only an air hardening, but also a hot water hardening steel. It can be forged at a much higher heat than usual without fear of injury, but care must be taken that it is thoroughly heated. To harden the tool it must be reheated to a full yellow heat (lemon color) and placed immediately into a cold blast from a vacant forge or in the hole in a blower pipe until quite cold. It can also be hardened with perfect safety in hot water which, however, must be so hot that one cannot bear his hand in it. It is a universal steel, being suitable for all kinds and shapes of tools.

It is annealed in the ordinary way so that it can be machined and filed into any shape, and then hardened as above. Even the finest edges of thread tool tap, milling cutter or die remain sharp, and there is no likelihood of cracking, one of the greatest dangers of all carbon tool steels.

It must be worked at a higher heat than usual.

A tool 1 by 2 inches roughed an 11½-inch diameter shaft for a hoisting engine at 93 feet per minute, taking a ½-inch cut with a variation of feeds from 1-32, 1-16 and ⅛; 4 feet being the length required to cut. The same tool did the finishing cut of 70 feet per minute and was in perfect condition at the finish.

On cast iron the Novo air steel cut 35 feet per minute, ¾ inch deep cut, ¼ inch feed on roughing cut, and the same tool finished the cast iron at 165 feet per minute with 1-16-inch feed.

A tool 1¼x1¾ roughed a nickel steel tail shaft 11 inches diameter by 18 feet long, for a steamer, at 35 feet per minute, ½ inch deep cut 1-16 feed over the entire length, and the same tool finished the shaft and came out in perfect condition.

Another test was made with a 7-16-inch square Novo piece in a tool holder. Eight pieces of 1⅝ inch round machinery steel 34 inches long were roughed out to 1 9-16 inches at 108 feet to the minute, and the tool came out in perfect condition.

These tests indicate that this is a steel that will reduce the cost of turning various metals and is of interest to shop men from master mechanics down. Hermann Boker & Co., 101-103 Duane street, New York, are the United States selling agents.

The Homestead & Mifflin Street Ry. Co., financed by business men of Homestead, Pittsburg and vicinity, has recently begun the construction of a line from Homestead, Pa., to Lincoln Place, in Mifflin township, a distance of three and a quarter miles. It will cost $100,000, and is expected to be in operation by July 1. The new road will prove a great convenience to the people of the Third Ward of Pittsburg, Homestead, and to the residents of the hill district south of the borough, where there are practically no transportation facilities. The La Clede Car Company, of St. Louis, has been awarded the contract for the cars. Westinghouse motors will be used and the cars will be equipped with the Westinghouse magnetic brake.

Mr. Hill on the Nicaraguan Canal Scheme.

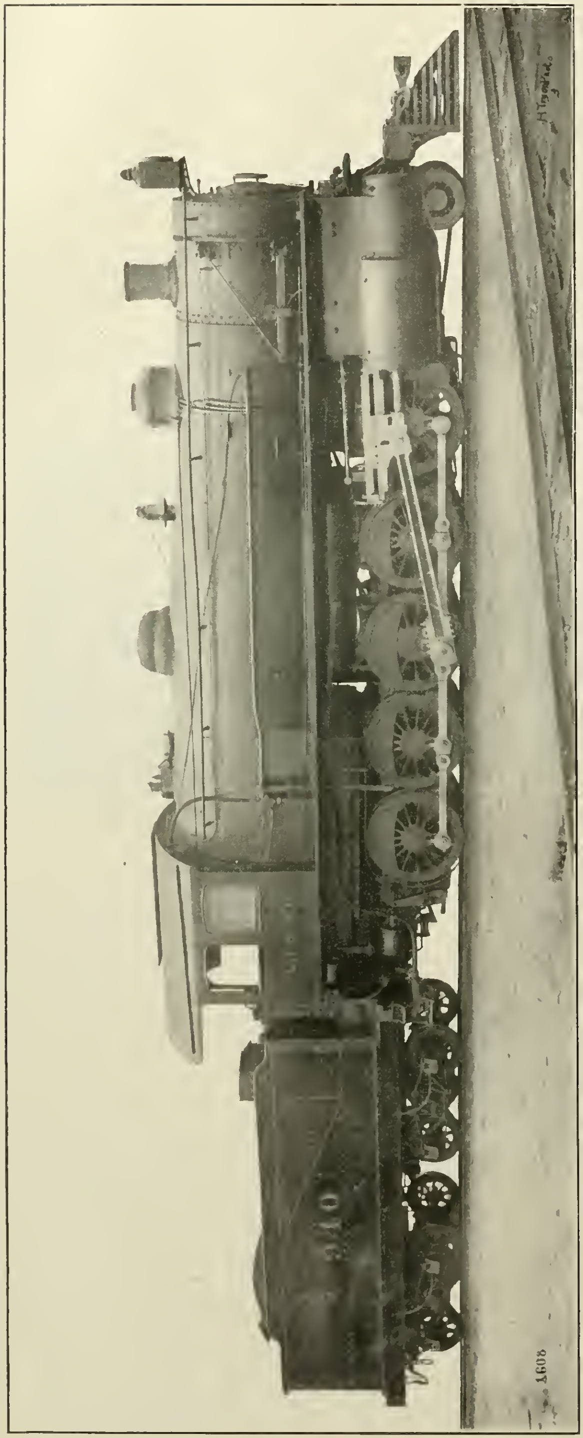
There is no great question before the American public to-day, on which the average Congressman displays so much tendency to follow ways that are dark, as on that of the Nicaraguan Canal. Mr. J. J. Hill, the railroad magnate, is a hard headed gentleman noted for his common sense. He appears to understand Congressmen, and paid his respects to them recently in the following scathing arraignment:

"Every one who has made any scientific investigation of the subject knows that Nicaragua is one of the most volcanic regions of the earth and that earthquake disturbances await any great public works that can be erected there. But what does your average congressman care about that? What does he care about a volcano, if it is not in his own district? You may lay before him the history of all the forty or more volcanoes of Central America, with a century record of earthquakes brought down to the last sixty days, and your Congressman who is talking 'Isthmian Canal' in glowing rhetoric will ignore the scientific facts completely and vote to spend $100,000,000 or $200,000,000 of the people's money right in the midst of the eruptions.

"You may stand him before a belching volcano and he would never see it, unless as I say, it were right under him in his own district, and then he would feel it, if he couldn't see it.

"Nicaragua is a dangerous and unfit place for any great works of a public character and, most of all, for a vast canal system built of concrete and masonry to which any earthquake or volcanic disturbance would be fatal. It is a nasty, crooked route, anyway, curving and dodging about among the volcanic peaks. It is not a safe place to put any big vessel."

A legacy of one thousand dollars has been left to the American Railway Master Mechanics' Association by Jerome Wheelock, an old associate member who was at one time regarded as one of the best authorities in the association on valve motion. His legacy may prove a bone of contention in the association, as the money known as the Boston Fund was until it was spent for scholarships in the Stevens Institute of Technology. We think the Wheelock legacy should be spent for a similar purpose without loss of time. A scholarship in Purdue University would be a very fitting use for the legacy. That institution is wonderfully popular among railroad men.



HEAVIEST LOCOMOTIVE YET BUILT.—BALDWIN TANDEM FOR SANTA FE.—267,800 POUNDS

The Heaviest Locomotive — Baldwin Decapod for the Santa Fe.

Once more the heaviest locomotive has been built, this time by the Baldwin Locomotive Work for the Atchison, Topeka & Santa Fe road, and the illustration is one of a large order.

There are many interesting details in these engines most of which will have to be held over until next month on account of not being able to get the necessary engravings ready. These will appear next month.

Among the noticeable details, however, are the cranes (one on each side) for handling the high pressure cylinders should it be necessary to remove them for repairs or to handle cylinder heads and valves. These are handy appliances and with the main and side rods now in use, a similar device for this purpose would be welcomed by many. It will also be noticed that the cylinders have a slight incline (1 inch in 24) and that the whistle is on its side to save head room.

The tractive power figures up to 62,593 pounds. The leading dimensions are as follows:

High pressure cylinders, 19 by 32 inches.

Low pressure cylinders, 32 by 32 inches.

Boiler diameter, 78¾ inches, staying, radial.

Firebox, length, 108, width, 78.

Tubes, iron; number, 463; diameter 2¼ inches; length 19.0 inches.

Heating surface, firebox, 210.3 square feet.

Tubes, 5,155.8 square feet.

Firebrick tubes 23.9 square feet.

Total, 5,390 square feet.

Grate area 58.5 square feet.

Driving wheel, diameter, 57 inches.

Journals, 11 by 12 inches, others 10 by 12 inches.

Engine truck wheels (front) diameter 29¼ inches.

Journals, 6½ inches by 10½ inches.

Wheel base, driving, 20 feet 4 inches.

Total engine, 29 feet 10 inches.

Total engine and tender, 59 feet 6 inches.

Weight on driving wheels, 237,800 pounds.

On truck, 30,000 pounds.

Total engine, 267,800 pounds.

Tank, capacity, 7,000 gallons.

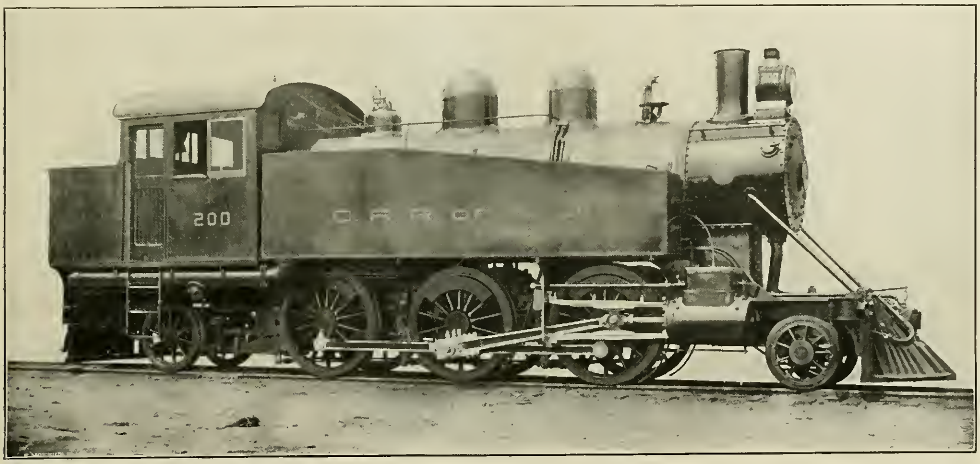
Tender, wheels, diameter, 34¼ inches.

Journals, 5 by 9 inches.

We have received from the Wabash Railroad Company the schedule of a remarkably fast run made by the Continental Limited from Decatur to Granite City. The distance of 105 miles was made in 95 minutes at an average speed, including stops, of 70 miles per hour. One stretch of six miles was made in 4 minutes at the rate of 90 miles an hour. The engine was of the Atlantic type with cylinders 19

by 26 and drivers 79 inches diameter. J. B. Sanford, engineer; F. W. Ghere, fireman; W. H. Kieran, conductor.

A fast New Jersey Central passenger train that never heretofore stopped at Coalport was brought to a standstill recently at that point by prayer, says a press dispatch. A clergyman who had been called to attend a funeral at Coalport was told that the latter was no stopping place. "Then, I'll pray for the train to stop," said he; and he did so, silently. As the train approached Coalport Engineer Lowder slowed down and brought the train to a standstill at the station. He said a secret influence impelled him to stop there. We have made inquiries about the case, but the silence of the officials is as mysterious as the secret promptings felt by the engineer.



BALDWIN SUBURBAN ENGINE, BUILT FOR NEW JERSEY CENTRAL.

Jersey Central Suburban Engine.

The engine here illustrated, which was recently built at the Baldwin Locomotive Works for the Central Railroad of New Jersey, has been designed especially for the heavy suburban service performed by the road for which it was built. As will be seen by the cut the engine is a novelty for American railroad work, being a double ender with the water tanks set at the sides of the boiler, an arrangement which is greatly in favor in Europe and makes a very compact engine. The engine is unusually powerful for suburban passenger service, having cylinders 18x26 inches, driving wheels 63 inches diameter, and a boiler carrying 200 pounds pressure. That makes the traction power over 22,000 pounds. The boiler is straight, 60 inches diameter at the smallest ring. The firebox is designed for burning hard coal and is 109 inches long, 72 inches wide, 55¼ inches deep in front and 44¾ inches deep in the back. The total heating surface is 1,821 square feet and there is 54.5 square feet of grate area. Liberal bearing surface has been provided, the main journals being 8½x12 inches and the engine truck journals 7x12 inches. The estimated weight with half supply of water and coal is 165,000 pounds.

Steel Ties Coming.

Wood has been so abundant on the American Continent that people are reluctant to believe that it is becoming scarce, and that the consumption is greatly in excess of the supply. Wood is so easily worked and there have always been so many workmen capable of manipulating it for all purposes, that railroad companies from their first inception became lavish users of wood. That material was employed in constructing all their buildings, it was used in building all the bridges and trestles from the single span leading over a small creek to splendid structures spanning great rivers. All the railroad cars were made of wood and for many years nothing else was ever dreamed of for track ties. That was the age of wood, but it has gradually changed towards metals; first with iron as a stepping stone, and now we have reached the age of steel.

Heavy railroad traffic was in its infancy when the officials responsible for the safe movement of freight and passengers began to realize that wood was a very unsatisfactory material for bridges. That led to the gradual introduction of iron and then steel. The popularity of wooden cars was so strongly fortified by universal use, and by the machinery designed for building and repairing them, that nearly everybody believed that no material could ever displace wood in car construction. A depression in the steel industry cheapened the price of steel for a few years, and steel makers encouraged the building of steel cars as a means of disposing of their product and the industry of steel car building jumped into giant proportions in a few years. That success was in its infancy when the steel makers began looking for another field where their surplus product might be employed and their attention was directed to the short lived wooden track tie. They were preparing to begin the conquest of that source of demand when the revival of business intervened, and all their product was demanded for established industries. In the case of steel cars, the supply stimulated and even originated the demand, and there is good reason for believing that had railroad companies been offered a good steel tie at a moderate price, they would have bought it as readily as they bought steel cars. The demand has languished for want of a good article being offered and pushed.

There are good reasons for believing that railroads will not long be compelled to put under their rails, the evanescent wooden tie for want of something more permanent and durable, for there is a concern possessing ample capital erecting works which will be devoted to the manufacture of steel ties on a large scale, and the ties will be sold at a price enabling them to compete with the wooden article. The moving spirit in this enterprise is Mr. James E. York, a metallurgical engineer of mature experience, who has been engaged in the rolling of iron and steel for nearly fifty years. Mr. York has devoted himself lately to studying out the problem of making steel ties that secure the rails noiselessly and are as convenient to handle as wooden ties. He has patented a variety of forms, but his favorite tie is

an I-beam of unequal flanges, which possesses much greater resistance than any other form of tie that could be put upon the market at a practicable price. He uses a variety of I-beam forms, some of them having dished heads, some of them have flat heads, and there is considerable diversity in the relative sizes of base and head. The ties are rolled out of old rails, a practice which secures cheap raw material with a minimum of labor in the manufacture of the finished tie. A worn-out steel rail is just as good as a fresh bloom for rolling ties by the process followed by Mr. York, and the form adopted seems to overcome all the points of weakness that have developed in other shapes of steel ties under heavy traffic.

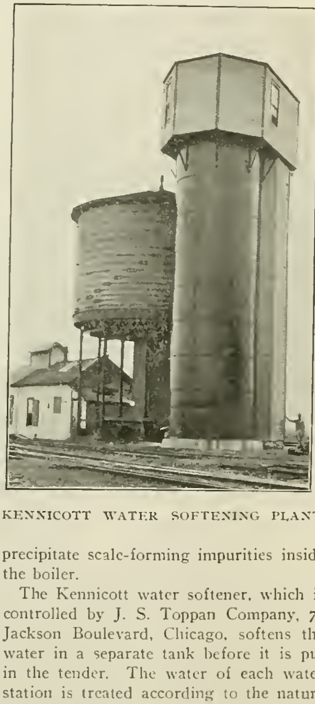
Mr. York learned the trade of a roll turner and there is nothing about rolled sections he has got to learn. He was the first iron master to roll iron I-beams adapted for building purposes, and he did it at a time when Mr. Abram Hewitt insisted that the operation was an impossibility, and the latter only admitted being convinced that it could be done after Mr. York showed him specimens of the finished beams. This line of experience is of very great value in supervising the work of converting steel rails into quite a different form. The operations involve much ingenious labor at the beginning, but after it is once well started the work goes on as expeditiously as the rolling of ordinary rails.

Although the use of steel ties has been very limited in America, they have been largely used in other countries where wooden ties are more expensive than they are here. The perishable character of wood induced people interested in maintenance of permanent way to experiment long ago with metal ties. Cast iron ties, and composite ties of wood and iron were used unsuccessfully, breakage making them more expensive than wood. As soon as mild steel began to be cheap, that material was tried and many railways in Europe are using nothing else. There are some parts of India where wooden ties cannot be used owing to the destructive ravages of ants, and railways built in these regions had to find metal ties many years ago, and the experience is to-day valuable to the railway world. The Madras Railway Company rate the life of a metal tie as 56 years, which is a very satisfactory guarantee of durability.

The experience of a great many railroad companies indicates that a steel tie is just as resilient as one made of wood. Besides the growing scarcity of wood, other considerations demand the use of more suitable material. The heavy rails becoming common, and the immense wheelage hammering them all the time, quickly draws the spikes out of wooden ties and presents a constant menace of spreading rails. A steel tie is a satisfactory guarantee against this line of weakness, for it keeps the rails absolutely the same distance apart. For these reasons we anticipate that steel ties will come as rapidly into popularity as steel rails did.

Effects from the Kennicott Water Softener.

One of the most troublesome difficulties that railroad men have always struggled with in regions where limestone and magnesia abound, has been the scale-forming ingredients in the feed water of locomotives. Remedies without number have been tried without success, the principal source of failure having been the practice of treating all hard water with the same method or compounds, and the attempts to precipitate scale-forming impurities inside the boiler.



KENNICOTT WATER SOFTENING PLANT.

The Kennicott water softener, which is controlled by J. S. Toppan Company, 77 Jackson Boulevard, Chicago, softens the water in a separate tank before it is put in the tender. The water of each water station is treated according to the nature of the impurities which have to be taken out of the water. That is a highly sensible and practical method and it is meeting with gratifying success wherever a purifying plant has been installed.

The annexed engraving illustrates the most recent installation of a water softener made by the Toppan people at Rossville on the Chicago & Eastern Illinois. Those interested in results will find the purifying process effected on that water deserving of the most serious consideration. In the well the water contained 20.52 grains of solid matter to the gallon, which is not an obnoxiously hard water as compared with that in many of the wells that supply water stations. Yet there are 11 pounds of solid ingredients in that water for every tankful of 4,000 gallons used. It is then not surprising that the heating surfaces soon get covered over with scale with all the destructive results so well known to every one connected with locomotive operating. After this Rossville water was treated with the Kennicott process only 3.97 grains of scale forming solids was left in it. That is quite soft water and its exclusive use on a railroad would put a stop to all the expense, annoyance and delay resulting from cracked sheets and leaky flues. We do not know of a better paying investment than it would be for a railroad traversing a calcaious district than that of installing a Kennicott water softening plant at every water station on the road.

One of our friends at The Needles, Cal., writes us: The Santa Fe has lost some of its best talent, and the engineers and firemen a friend in the departure of Mr. George Smith, late General Master Mechanic of Coast Lines of the A. T. & S. F. System. Mr. Smith in the past four years has brought order out of chaos. Power and shops were at a low ebb; to-day some of the best shops and power on the A. T. & S. F. System are on the coast lines, the most flattering results have been obtained. It is seldom that the new man finds everything as Mr. Smith's successor will find it. No unfinished business; no grievance committees sitting on the steps or disgruntled employees; power and shops of high standard. Prior to Mr. Smith's coming, Albuquerque west was considered a good place to keep away from; the reverse is true at present. Mr. Smith's departure is regretted from division superintendent to wiper—all who could, wished him Godspeed. Committees of engineers and firemen, en masse, met him to wish him good by. He will be pleasantly remembered for many a day on the coast lines. The pace he set will keep his successor hustling.

Mr. S. M. Vauclain, general superintendent of the Baldwin Locomotive Works, of Philadelphia, and inventor of the Vauclain compound locomotive, lectured before the engineering societies of Lehigh University a short time ago on "The Locomotive."

The Baltimore and Ohio Railroad Company have issued a very attractive card directing the attention of the public to the 36th annual encampment of the G. A. R., which will be held at Washington, D. C., October 6 to 11. On the back of the card is a synopsis of the events of the Civil War which happened in the neighborhood of the Baltimore and Ohio Railroad. We advise people interested in this historical route to apply for the card, which will be sent free.

The Practical Mechanic vs. The Practical Engineer.

After carefully reading editorial, entitled "The Practical Mechanic vs. The Mechanical Engineer," in your paper for this month, I have concluded that the article was written, not because the author of same believed in the views expressed, but to bring out a discussion of the matter.

It is undoubtedly a fact that there has been a gradual increase in the number of college-trained mechanical engineers who have become superintendents of machinery on railroads; the same is true of college-trained civil engineers who have forged to the front as railroad officials. In the railroad world it is customary to judge men by results obtained, and up to the present time the appointment of college-trained engineers to positions of responsibility has not brought about bad results. College-trained engineers are pre-eminently numerous and prominent on the Pennsylvania Railroad, which, taking all things into consideration, it must be admitted, is a great system.

The editorial states that, "If locomotives or boilers or cars have to be designed, the details are not worked out by a system of engineering reasoning concerning what forms and dimensions will produce the best results." I must differ with this statement. The designing of equipment for railroads is being conducted on more scientific principles every day; one great reason for this being the necessity of producing locomotives and cars of the greatest capacity with the least dead load.

The superintendent of machinery on a large railroad, of all things, must have plenty of executive ability. This is something which is born in a man and cannot be acquired. On the other hand, if he naturally has executive ability it will necessarily be improved and broadened by a liberal education. The editorial states that "Few of the railroad presidents and managers who have the appointment of men to the heads of mechanical departments have enjoyed scientific education themselves, and on that account they are frequently disposed to over-estimate the value of a college education for their subordinates." It has been my privilege to be acquainted with a number of railroad presidents and managers, several of whom were fortunate enough to obtain a college education, while the others were not. I have found that the railroad presidents and managers with a college education are more desirous of having college-trained men for their subordinates than the presidents and managers who have not enjoyed this advantage.

Practical experience is a good teacher, but sometimes slow and expensive; and the engineer with a college training, after obtaining a certain amount of experience, should be able to get results with a less expenditure of time and money than a man who has to depend upon practical experience alone. I do not think there is any inclination to be unfair to the men who have obtained their knowledge by practical experience, but I contend that, everything else being equal, the college-trained man is the one that eventually obtains the best results, and that is what the railroads are after.

S. Higgins,
Supt. M. P. & M.

Dodos, Brakes and Valve-Gears.

I am sorry to say I have been so busy that I have only now had time to read the whole of your issue for January. and to note that at page 5 therein my good friend C. Rous-Marten genially falls foul of me for a statement I made in my lecture before the British Association for the Advancement of Science at its Glasgow congress.

I declared emphatically that, "The single-driving wheel is as dead as the dodo." He says I forgot your sage saying, "Not to prophesy unless you know," for, "it did not take a month to see *that* implied prediction that no more single-wheelers would be built absolutely falsified."

Of course, I never said, nor meant to say, *that;* since I well knew such types were still in a very few cases being built. My whole paper was based on the future as judged by the present and entitled, "Railway Rolling Stock: Present and Future." At the outset I took care to say, "I only dwell on the first half of my subject—the Present—so far as it contains finger-posts, lessons and admonitions as to the Future." Considering, therefore, types suited for modern and economical work, and the fact that the world at large had ceased long ago to build them, I marked down single-driving wheels as antique birds. There are of course hundreds of them still running about Great Britain, but they hardly come into practical politics.

As to Mr. Leith's letter in your May issue, page 217, I fear we shall have to differ, I would only add that it is in England as well as Scotland that I find drivers who have to work both brakes, who so strongly prefer the Westinghouse. And I am glad Mr. Leith personally takes this view.

An article in your April number, page 179, on the new valve-gear in use on the Great Northern speaks of a saving of 40 per cent. in coal. I hardly think such a claim has been made—as a matter of fact, the average over a large range of tests was from 10 to 15 per cent., taking no account of the fact that the old engine with the new valve-gear took much heavier loads. The fact, however, is, that no one can dogmatize from the results beyond what the Great Northern

Railway officers say themselves, viz., that there is a great deal in it. This gear has lately been fitted on a new express engine for the fast main line services and is giving excellent results, especially uphill. I should advise your readers to possess their souls in patience; meantime, since the valve gear will shortly be fitted to various types of locomotives in all classes of service, and after a time plenty of information should be available. The tests on the old engine have been kept a secret so far as possible, since the Great Northern people wished to have the credit of bringing out, what seemed such a good thing, themselves.

Norman D. Macdonald.

Edinburgh, Scotland, May, 1902.

A New Balanced Valve.

In designing this valve, Mr. J. T. Wilson, of the American Balance Slide Valve Company, of Jersey Shore, Pa., has taken steps to remedy the imperfect balancing due to the effect of the balanced area remaining constant while the pressure under valve varies at the different points of the stroke.

To do this he makes the balance plate a counterpart of the valve seat and uses the valve shown which automatically varies the balance so as to maintain an even pressure at the different points of stroke.

The valve is light and double ported, as will be seen, but different from an Allen valve. By arranging the ports in this way the valve can readily be made of any desired length so as to have the ports straight at the ends of cylinder and secure the advantages claimed for a piston valve without its bad points.

Referring to the sectional view of the valve in its central position on the seat, Fig. 1, we find the valve in its heaviest position; that is, subject to pressure on its back the entire area of the valve face if there was no balance on the valve. It is balanced by the large ring usual in the American valve which prevents the steam from exerting a pressure on the back of the valve, according to the area contained in its diameter. This area is all that is possible to take off of the valve and not cause it to leave its seat. Here, then, is the maximum balance that will maintain a steam tight joint at the face of the valve. Moving the valve to the position shown in Fig. 2, the valve begins to admit steam to the cylinder port. As soon as the cylinder is full of steam, or when the valve has returned to point of cut off the steam in the cylinder exerts an upward pressure on the face of the valve equal to the area of the steam port. If this upward pressure, on the face of the valve at this position, was not counteracted, it would, of course, lift the valve off its seat. The valve, being fully balanced in its central position, would not stand this increase of balance by the pressure in the port pressing upward on it, and it would, therefore, be lifted off its seat. It has therefore been necessary to underbalance valves by this amount to prevent their lifting at this position.

In this valve this pressure in the port is counteracted by the fact that the steam

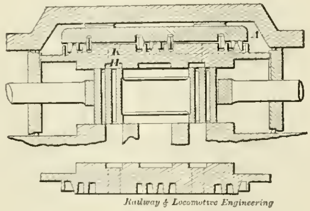


Fig 1.—CENTRAL POSITION.

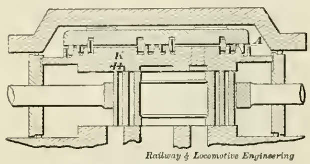


Fig 2.—OPENING STEAM PORT.

gets on the top of the valve through the ports in the valve, and the pressure is equal on both faces of the valve. This, in turn, leaves an upward pressure on the balance plate on top of the valve, in the pocket port "*H*," which would lift the plate off of its seat if we did not counteract this pressure on top of the plate. The steam, therefore, is admitted to the interior of a small ring through the passage "*K*," the small ring having an area equal to that of the steam port. The pressure in the port is, therefore, counteracted entirely and has no effect whatever upon the valve.

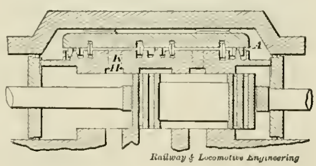


Fig. 3.—WIDE OPEN.

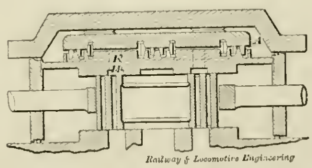
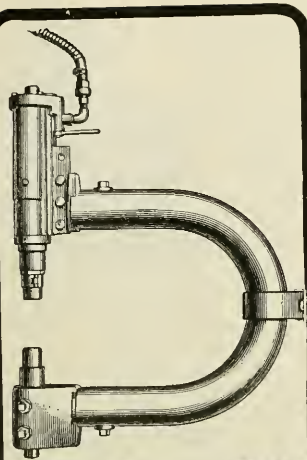
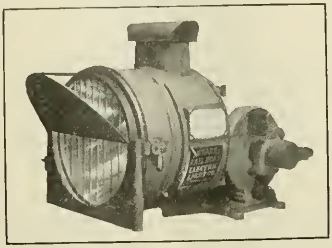


Fig. 4.—EXHAUST JUST OPENING AT LEFT.



The ordinary valve has another position in which it is in danger of lifting if it is properly balanced in its central position, that is, at the point of extreme over travel, shown in Fig. 3, marked wide open. In this position the ordinary valve is subjected to an upward pressure on its face to the amount equal to the area of the face of the valve exposed by overtraveling the seat. This exposed area is the same as that of the port and is taken care of in the Wilson valve, so that the overtravel is entirely neutralized by the valve traveling out from under the upper seat, at the same time that it travels over the lower seat. The seat is so proportioned that the valve will travel to the edge of the seat at the least possible cutoff at which the engine can work. This allows the use of as great a valve travel as is deemed necessary and at the same time maintains a



EDWARDS ELECTRIC HEADLIGHT EQUIPMENT WITH REFLECTOR FOR VERTICAL BEAM.

uniform frictional contact of the valve and seat, and, with the one change in the balanced area and the balancing of the valve at overtravel seems to meet the requirements of a valve at the different points of its travel.

Another feature in this valve is the double opening for exhaust which is more to be desired than for the admission of steam. This feature is optional, however, and can be dispensed with if desired, and the valve is susceptible of many modifications. They are made for internal or external admission, and for the lowest possible cylinder clearance, as well as for seats made for the ordinary slide valve, or they can be applied to any existing engine at a moderate cost. They are guaranteed under any pressure as high as 250 pounds, and mechanics will note that there is not a screw, bolt, spring or other small part about it.

The valve shown is an application to an old engine, being made without changing steam chest cover, pressure plate or steam chest, the only change necessary in applying the valve being in the yoke.

The Cleveland Pneumatic Tool Company have appointed the Compressed Air Machinery Company of San Francisco, Cal., to represent them on the Pacific coast.

Master Car Builders' Important Air-Brake Subject.

At this year's convention the master car builders will take up in the form of a committee report a subject of greater importance, perhaps, than any which has been acted upon by that association for a number of years past. That subject is the "Standard Methods of Cleaning Air Brakes and Additional Prices for Labor and Material."

At last year's convention this subject was simultaneously presented to the master carbuilders by the Air Brake Association and the Rocky Mountain Railroad Club in the form of a petition for better prices for cleaning and testing triple valves and brake cylinders. The petition was passed to the committee on prices and standards and was refused. The convention body, however, disagreeing with the committee's refusal, and believing that 25 cents was an insufficient amount to pay for cleaning and testing both brake cylinder and triple valve, overruled and reversed the committee's decision. After a lengthy discussion and a committee session, a decision was arrived at which increased the price to 20 cents each for the triple valve and brake cylinder, making a total price of 40 cents against the former price of 25 cents for both parts. This price was a compromise, the petitioners asking for a flat price of 50 cents against the former flat price of 25 cents. It was also considered probationary in a degree, being adopted for a year's trial, after which it could be rejected, modified or accepted.

The burden of the discussion of the opposition was that while the committee had possibly given its decision somewhat hastily and without duly investigating the real and full merits of the petition, the subject was, nevertheless, one demanding extreme conservatism in its treatment. The opposition believed the responsible and conservative body of master car builders should make haste slowly in the matter, and retain the old recommended price, even though it be insufficient, rather than hastily, without probationary experience, increase the price to the figure petitioned for by the Air Brake Association and Rocky Mountain Railroad Club.

The supporters of the petition argued that it was manifestly unfair to expect a man to clean, oil and test a brake cylinder and triple valve for 25 cents; that the price would encourage negligence and result in hasty half-finished work; that "chalking" would be resorted to, and the whole end in a fiasco or burlesque. They believed that the placing of a price was made with the object of having the work done; that experience had proved the price too low, and unless it was increased, the object sought for in the better maintenance of air brakes would be defeated and lost. They did not believe that "chalking" would be perpetrated

very long after the increased price went into effect, if that feature was closely watched and railroads were fairly honest in these matters as in other things. However, there would doubtless be disputes and arbitration cases until this matter was fully launched and received the same prominent attention and understanding as other similar matters now enjoying the master car builders' supervision and guidance.

Thus the matter was disposed of last year. This year the committee appointed to report on "Standard Methods of Cleaning Air Brakes and Additional Prices for Labor and Material" will doubtless present a most interesting and valuable paper. Not only will it probably tell whether the increased price for cleaning, oiling and testing triple valves and brake cylinders adopted at last year's convention was too high or too low, but it will probably go deeper into the subject than the Air Brake Association and Rocky Mountain Railroad Club had hoped to encourage in making the petition for higher prices. At least it will not be like the past work of the Master Car Builders' Association if this is not done.

The resolution as presented contains an incongruous slip that will probably be searched out and eliminated by the committee. By some error the resolution as presented requires that both the brake cylinder and triple valve shall be removed from the car for cleaning and testing. This is plainly a mistake, as there is no intention to or reason for removing the brake cylinder from the car for cleaning or test. The triple valve alone shall come off.

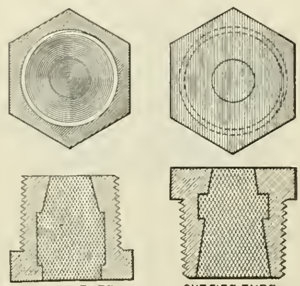
The Pullman porters on the parlor cars running via Reading system to Atlantic City complain that there is so little dust on that line, due to extremely perfect ballast conditions, that they never get a chance to use a whisk broom, and as a consequence the tipping system is becoming obsolete, or would become so, if it were not for the fact that the roadbed is so smooth and the trains run so swiftly that it keeps the passengers in such a good natured frame of mind, that they naturally have to hand out something to somebody to show how pleased they are. The engines on the Reading burn hard coal—there is no smoke.

Some Recent Developments in Locomotive Practice.

This is a book of 75 pages, 6¾x4 inches, written by C. J. Bowen Cooke, assistant running superintendent, locomotive department, London & Northwestern Railway, and sent to us by the Locomotive Publishing Co., London. The book is an adaptation of two lectures delivered at the Royal Engineers' Institute, and is devoted mostly to descriptions of the design, construction and operation of locomotives belonging to the London & Northwestern Railway; but in describing the motive power of that line the author produces a series of pictures which reflect rather faithfully the locomotive practice of the British Isles. The work is quite lavishly illustrated by excellent cuts and will prove a useful reference to people desiring information about foreign locomotive designs.

The Lunkenheimer Fusible Plug.

The Treasury Department, in enforcing the provisions of Section 4436 of the United States Revised Statutes, regarding the specifications as to the manufacture of fusible plugs, have directed attention to this well-known article, and require that all plugs used on boilers of steam vessels should be made of bronze and have no other filling but pure Banca tin. Many fusible alloys have been used,



INSIDE TYPE OUTSIDE TYPE

which, although melting at very near the same point as Banca tin, were not absolutely reliable. Since the disaster at Philadelphia last fall, the United States Steamboat Inspection Service of the Treasury Department, has taken cognizance of the fact that inferior plugs were being used, and issued a circular requiring that all fusible plugs should be filled with pure Banca tin and stamped with the manufacturer's name, and that an affidavit setting forth this fact should be filed with the inspector having charge of the boiler inspection at whatever point the plugs are used.

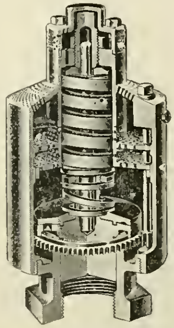
Two forms of plugs, namely, the outside and inside patterns are shown with this. They are made to be screwed in, either from the inside of the boiler or from the outside through the fire-box or shell. They are manufactured by the Lunkenheimer Company, of Cincinnati, Ohio.

The C. W. Hunt Company, West New Britain, N. Y., supply all kinds of coaling apparatus for railroad coaling stations. Those who contemplate making any changes in their equipment at coaling stations ought to send for an illustrated catalogue of the Hunt Company's appliances.

Crane Safety Valves.

The principal and most important feature of this valve is the self-adjusting feature which obviates a troublesome requirement that is usually necessary. This refers especially to the patented auxiliary valve and spring which are independent and entirely automatic in operation.

It is necessary in pop valve construction to have a "huddling" chamber into which the steam expands when main valve opens, thereby creating an additional lifting force proportionate to this increased area and greater than the force of spring,


No. 28 LOCO. OPEN POP.

thus holding the valve open until pressure is relieved. Means for relieving this chamber of pressure in order to allow the valve to close promptly and easily. This is accomplished by the self-adjusting auxiliary valve and spring, which permits a greater range in setting pressures with the least waste of steam and prevents chattering or hammering, as the action of closing is easy and gradual. These valves are made both open and muffled and the Crane Co., Chicago, will be glad to explain further details and operation.

"Royal Blue," the monthly illustrated magazine of the Baltimore & Ohio for May, is a particularly attractive issue. "Trouting in the Mountains" is a beautifully illustrated and well written article which carries us away from stuffy offices into the fresh air of the mountains. The whole of the magazine is got out in remarkably fine shape. Readers interested in outing will receive a copy on application to the Passenger Department of the Baltimore & Ohio Railroad, Baltimore, Md.

A number of railroad companies have begun the practice of publishing our speed table on their official time cards. That table has worked itself into great popularity and is carried by thousands of railway officials and is referred to daily. It was first worked out by Mr. A. G. Leonard when he was assistant to Mr. H. W. Webb, vice-president of the New York Central Railroad, for the purpose of putting on a watch dial. It was put on two or three dials and a firm of watchmakers were prepared to put it upon the market, but no active demand was made for it.

The new passenger station to be erected by the Pennsylvania Railroad in Washington, D. C., is described from the plans as "the finest structure of its kind in the world." It will be of white marble, 700 feet long and is estimated to cost nearly $5,000,000. Arrangements have been made to lay twenty-one tracks in the station train shed and there will be room for seven additional tracks. The tunnel under Capitol Hill will cost about $1,640,000 and the entire cost of the proposed joint terminal improvements in Washington will be about $12,361,000. Of this amount the federal government and the District of Columbia will pay $1,670,000.

The Chicago Pneumatic Tool Co. write us: Our president, Mr. J. W. Duntley, has just returned from a trip through Europe. While there he secured orders for an aggregate of 2,700 "Boyer" and "Little Giant" pneumatic tools, as well as for 25 of our "Franklin" Air Compressors, for early delivery. Mr. Duntley states that the Europeans now realize the absolute necessity of using labor-saving tools so as to reduce the cost of manufacture and counteract the influence of the "American Invasion" and enable them to compete for the markets of the world. The company inform us that they have received as many orders during the first two weeks of May as they had previously received in any entire month.

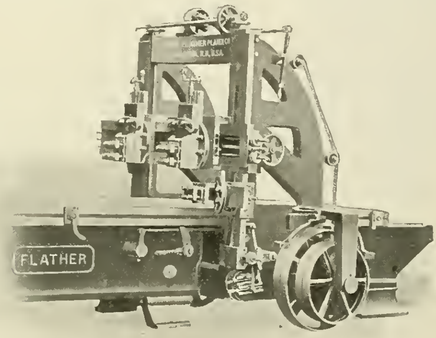
We have been favored with patent office specifications from Mr. O. P. Holt, of Colorado Springs, Col., showing his substitute for the link motion for locomotives and other engines. This has a shifting eccentric together with the necessary connections for moving it into the various positions. While the motion thus obtained is practically identical with that of the link motion it has never been found practical in locomotives, although tried many times. In stationary work, where the service of the eccentric is controlled by the governor, it is a much easier problem than inducing manual control from the cab of the locomotive.

A very neat little illustrated booklet has been issued by the Niles, Bement, Pond Company, illustrating a few of their best known tools. It is convenient for the pocket and will be found useful by shop foremen and others as a pocket reference. It is the intention of the company to distribute the booklet at the "Crystal Palace Exposition" in England.

A Planer for General Work.

One of the first requirements for a good planer is a rigid bed and housings. This has been recognized by the Mark Flather Planer Company of Nashua, N. H., as will be seen from the accompanying illustration. Added to these is a powerful gears drive, all of which are inside the bed, making a tool that is capable of doing hard work and lots of it. Care has been taken, however, to adapt it to light work as well and it is well adapted for general shop work.

This is the 36-inch size, which will plane nearly 37 inches wide and high. It is supplied with three heads as shown and weighs 15,000 pounds just as it stands.



NEW 36 BY 36 INCH PLANER BY THE MARK FLATHER PLANER COMPANY.

The Westinghouse Electric & Mfg. Co. has recently issued a very interesting and attractive circular describing "Electric Motor-Vehicle Equipments." This company has for five years supplied motors to the electric vehicle industry and now offers a complete line of standard automobile equipments comprising everything of an electrical nature, except storage batteries, pertaining to the motive power of an electric vehicle of any type or size. This circular will be sent upon request.

The industrial business of the country is exceedingly active. The railroads have all they can do, and more. Every available engine and car is in use, and still the cry for more comes from the shipper. Delays in freight shipments and consequent complaints are numerous. Pittsburg seems to be the most congested of all cities, frequently more than a week being required to move a car from the shipper to the outbound train, or vice versa. So says the complaining shipper.

The sixty thousand mark has been passed by the Pressed Steel Car Company of Pittsburg, Pa., in the manufacture of pressed steel cars. The company's output up to March 27, 1902, aggregated over 60,000 finished cars, or sufficient to make a solid train of cars 360 miles long. The cars built by this company have practically revolutionized the present methods for freight car transportation, the pressed steel car being much lighter in proportion to the carrying capacity than the old style wooden cars in use prior to 1897. The works of this company are pushed to their fullest extent, delivering over 100 finished cars per day, in addition to a large number of trucks, bolsters, center plates, and other pressed steel specialities for wooden and steel cars.

On March 20, engine 27, on passenger train on the F. W. & D. C. Ry., in Texas, while running at the rate of 30 miles per hour, broke a side rod, injuring Fireman R. Bigger and Engineer J. H. Kelley, but did not break air pipe connection so as to apply brakes. Mr. Kelley recovering from the shock saw the situation and climbed over the top of broken cab on running board and opened angle cock on front end of train pipe, thereby stopping train. After stopping the train he discovered Fireman Jordan in a dazed condition in cab and rescued him before serious injury from escaping steam. The good judgment and bravery displayed by Engineer J. H. Kelley is of high order and very commendable.

The Joseph Dixon Crucible Company have issued a "Mail Card" containing about a yard of illustrations showing bridges and other structures where the Dixon silica-graphite paint has been applied. That paint does not require any recommendation from outsiders, for it is a standing advertisement of its own merits. The mail card will be sent to those interested on application to the Joseph Dixon Crucible Company, Jersey City, N. J.

Armstrong Brothers' Tool Company, 617 Austin avenue, Chicago, Ill., have issued a 1902 catalogue. It contains their full line of tool holders, as well as their new lathe log and planer jack.

Among the publications which the Post Office Department changed from second class to third class was "The Pocket List of Railway Officials." An appeal from this ruling was taken to the Supreme Court of the District of Columbia and a decision has just been rendered against the postmaster general. The Pocket List again enjoys the privilege of being carried by pound rates and Manager J. Alexander Brown is again smiling.

Spon & Chamberlain have left their old address on Cortlandt street and now occupy large and better quarters at 123 Liberty street, New York.

The Phenix Lubricator Pump is an apparatus which provides a positive feed for valves and cylinders. It puts the oil to the parts where it is wanted in the quantity wanted. It is made by the Phenix Metallic Packing Company, 7 South Jefferson street, Chicago, Ill. Those interested ought to send for an illustrated catalogue.

The Cleveland Twist Drill Company have issued a very neat catalogue of their tools. As they have been in this line of business since 1874, their line is large and varied, and will interest any mechanic. Their snap and limit gages for inspectors are both simple and practical.

The American Steam Gauge & Valve Mfg. Co., of Boston, are sending out a very neat pamphlet of their pop valves and gages.

The Bement, Miles & Co. branch of the Miles, Bement, Pond Company have issued a steam hammer catalogue which is a fine piece of catalogue making. The half tones are beautifully done and the text is clear, concise and interesting. The section on general instructions includes erecting, starting and maintenance and should be in the hands of every man handling steam hammers.

The Handy Car Equipment Company, Old Colony Building, Chicago, has taken over the sale of the American Dust Guard, manufactured and formerly sold by the American Dust Guard Company of Columbus, Ohio.

The American Locomotive Sander Company, Philadelphia, Pa., have had plans made of a practical sanding house, which they will mail free to anyone who can make use of them. No claim is made for originality and the old cast-iron drying stove is shown (although they feel that probably there is a better way) but they wish to assist railroads in obtaining at small cost, sand that will give entire satisfaction with the modern sander.

The new catalogue of the Philadelphia Pneumatic Tool Company shows their line of tools and their application as well. It also contains much useful information concerning the capacity, weight and air consumption. This is information that all shop men are interested in.

The Ashton Valve Company have moved their New York office from 121 to 110 Liberty street, with Chas. H. Buckelen in charge.

The J. A. Fay & Egan Co., of Cincinnati, will be represented at the convention by their second vice-president, Mr. A. N. Spencer.

A. Leschen & Sons Rope Co., St. Louis, have favored us with a small catalogue showing their rope and appliances. It also contains full directions for splicing wire rope which is of value.

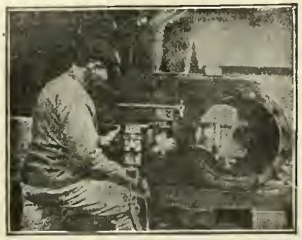
Engineer W. H. Eaken, of the Clifton Forge Division, Chesapeake & Ohio Railway, is loud in his praises of the Kincaid stoker on engine 375 of that road. He says he never has plenty of steam on these big engines when fired by hand and that the stoker keeps a uniform pressure, prevents nearly all the smoke and is easier on flues.

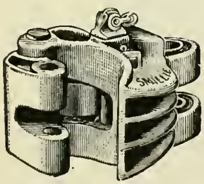
The Chicago Pneumatic Tool Company recently received an order from one European concern for 150 pneumatic tools.

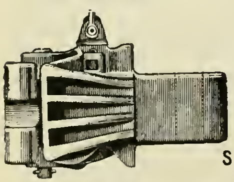
Engineer James B. Sanford, of the Wabash, at Decatur, Ill., is very enthusiastic over the performance of the Richmond locomotive No. 607 which he is handling on fast runs. He attributes part of his success and freedom from delays to the use of Dixon's graphite mixed with his valve oil. He recently made a run of 105 miles in 95 minutes, including two station stops (5 minutes total) and a water stop.

That the American locomotive has outgrown its clothes is graphically evidenced by the tearing out of the turntables of a few years ago, and the widening out of roundhouse stall entrances. In some instances the roundhouse itself is being dismantled and replaced by a larger and more commodious one.

The Bowery Bay Building and Improvement Co., of New York city, are to be furnished by the Buffalo Forge Co. with a 200 horse power horizontal center crank engine for electric light plant. This firm bought the Buffalo Forge Company's engine awarded gold medal at the Omaha Exposition in 1898, which has been in active service at their plant since date of purchase. The order just entered calls for the same type engine of a larger horse power.







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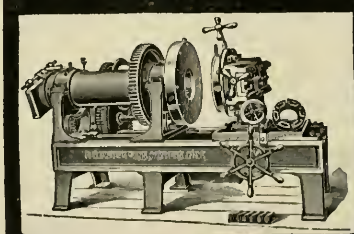

Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XV. 174 Broadway, New York, July, 1902 No. 7

European Railway Jottings.

BY CHARLES ROUS-MARTEN.

TEN-WHEEL PASSENGER ENGINES BECOMING POPULAR.

No information is as yet available as to the work done by the new Great Western ten-wheeler to which I referred recently. (Illustrated on this page.) I hear she is now in the paint-shop, so I anticipate that ere long she will take her place in the regular running. It will be very interesting to note the result. In respect of her six coupled 80-inch wheels, Mr. Dean's engine, No. 100, stands on the same footing as Mr. Worsdell's North Eastern engine, No. 2111, which also has 80-inch wheels. But as regards their cylinders, there is almost the widest possible difference. Mr. Worsdell's locomotive has 20-inch cylinders with 26-inch piston stroke. Mr. Dean's has 18-inch cylinders with 30-inch piston stroke. Here then will be afforded a useful chance of comparing the two strongly-contrasted methods.

Another point of difference, although the divergence is less widely marked, consists in the fact that whereas Mr. Worsdell employs 1,750 square feet of total heating surface with 200 pounds steam pressure, Mr. Dean uses no less than 2,400 square feet of heating surface with the same pressure and with the supplementary advantage of a Belpaire firebox. This apparently gives an advantage to the Great Western engine, but on the other hand the North Eastern engine has always seemed to me to possess abundance of steam.

Yet another British locomotive superintendent has joined the movement in the direction of using six-coupled locomotives for passenger service and eight-coupled for freight work. Mr. J. G. Robinson has designed and is building at the Gorton works of the Great Central Railway, near Manchester, two engines of types quite new on that line. One is a ten-wheeler with six-coupled driving wheels, 72 inches in diameter, and a leading four-wheeled bogie. The cylinders, 19 inches in diameter with 26-inch piston stroke, are placed outside the frames.

This has not been done on the Great Central Railway for nineteen years, the previous outside cylinder engines being the well-known twelve single-driver expresses designed and built by the late Mr. Charles Sacré, originally numbered 309 and 500-510. These were among the few of the outside cylinder type ever used on that railway where inside cylinders have always been preferred. They have done excellent service in their time and are still at work, but renumbered 104-115. Single-wheelers have seldom appeared on the Great Central, but just before his retirement Mr. H. Pollitt designed and built six very fine locomotives of that type, with 93-inch drivers and cylinders $19\frac{1}{2}$x26 inches, and a leading bogie. In these, however, the cylinders are placed inside as they are also in the earliest express engine designed by his successor, Mr. Robinson, the present chief mechanical engineer. Thus the employ-

GREAT WESTERN TEN-WHEELER REFERRED TO IN MR. ROUS-MARTEN'S LETTER.

ment of outside cylinders is almost as much a novelty on the Great Central as the use of six-coupled drivers for express duty and eight-coupled for freight purposes.

The boilers of the new Great Central ten-wheelers are 57 inches in outside diameter, and have 1,760 square feet of total heating surface, with a steam pressure of 180 pounds per square inch. The eight-coupled freight engines are identical in the dimensions of boilers and cylinders, and have the same steam pressure, 180 pounds. The coupled wheels are 55 inches in diameter and there is no bogie or pony-truck. The tenders used with these new engines are the same in both classes and carry 3,250 gallons of water.

Mr. Robinson is also bringing out a new class of tank engine for the Great Central suburban services which are extensive in the neighborhood of Manchester and Liverpool. The tank engines hitherto employed on this railway have been eight-wheeled, the two middle pairs of wheels coupled, and single pairs of wheels with radial axles being placed under the leading and trailing ends respectively. The new engines will differ from these in being much larger and in having a four-wheeled leading bogie, thus becoming ten-wheeled locomotives. They will have 67-inch coupled wheels and 1,143 square feet of heating surface. Their tanks will carry 1,450 gallons of water.

A DECAPOD SUBURBAN ENGINE.

But the most tremendous and startling new departure of all is that just taken by Mr. James Holden—of liquid fuel-burning fame—on the Great Eastern Railway. Everybody who knows anything at all about British railways is aware that the Great Eastern Railway carries on a suburban traffic whose magnitude is simply stupendous and unparalleled. It is no uncommon thing for 1,100 trains to be despatched in a single day from the Liverpool street terminus, which is the largest station in London, and has no fewer than eighteen separate platforms for trains to arrive at and depart from. The suburban trains which serve a vast residential area inhabited chiefly by what is called "working class," usually consist of sixteen coaches, each seating 50 to 60 persons, and often taking a standing complement of fully 50 per cent. more. These trains, moreover, have to stop every half mile and sometimes oftener. Thus it is a matter of supreme importance to be able to start and stop them quickly in order to get them out of the way and clear the road, as high speed cannot possibly be attained in those short-station intervals.

For this class of duty Mr. Holden first introduced a small and handy, but powerful, six-wheeled tank engine with 48-inch wheels all coupled, and cylinders 16x24 inches. They were in fact an enlarged edition of Mr. W. Stroudley's famous little "Terriers" on the London, Brighton & South Coast line. These did excellent work but are becoming "outclassed" by the enormous growth of the traffic which has compelled broader vehicles to be used, as the stations and sidings will not accommodate longer trains. Thus the new five-compartment coaches seat six a-side instead of five, and so hold 60 instead of 50 seated passengers. Moreover, it has become urgent to send more trains and therefore to clear the road more quickly than hitherto.

Keeping in view the needs of the situation, Mr. Holden has just designed a type of suburban locomotive which is absolutely novel, not only in Britain, but also, so far as I am aware, in the whole world, for the class of duty it will have to perform. Mr. Holden has not been content merely to advance from six to eight coupled wheels. He has boldly "gone one better still" and adopted the Decapod type. His new locomotives will run on ten 54-inch wheels all coupled.

This in itself would be a breath-taking-away departure. But Mr. Holden has yet another surprise for us. He has also adopted a three-cylinder non-compound design for the new locomotive. There will be one inside cylinder and two outside ones, each 18½x24 inches. So that the engine will be a simple high pressure one but with three cylinders instead of two or four. The crank will be disposed at suitable angles to give easy and prompt starting effort, and it is estimated that a speed of 30 miles an hour will be attained in half a minute after starting from a state of absolute rest.

The three cylinders will be supplied by a huge boiler, the largest ever yet seen in British practice, being no less than 63 inches in diameter with a length of 14 feet 9 inches. The heating surface of the tubes will be 2,638 square feet; of the firebox, 131 square feet, giving a total of no less than 2,769 square feet, and the grate area will be 36 square feet. The ten-coupled wheel will be got within a total wheelbase of 19 feet 8 inches. The weight of the locomotive in working order will be 60 tons. The wing-tank will hold 2,000 gallons of water and the bunkers 3½ tons of coal. I shall have more to say about this novel locomotive when she comes out of the Stratford shops.

POWERFUL FRENCH ENGINES.

One of the most interesting features of the latest continental practice has been the use of large engines of the consolidation type for the heavy grades which occur on some sections of the Chemin de Fer du Midi, or Southern Railway of France. These grades are in some cases as steep as 3.3 per cent., one of which extends for ten miles on end, from Aguessac to Engayresque. Hitherto these severe gradients have been worked by the four-cylinder compound engines of the ten-wheeler type, to which I have previously referred. These enabled the loads of passenger trains to be increased from 85 to 135 tons behind the tender over those grades. But it was deemed to effect a proportionate increase in the loads of the freight trains, viz., to 200 tons or more.

Accordingly the new locomotives were designed by Monsieur Moffre, chief mechanical engineer, and have been built at Belfort by the Société Alsacienne des Constructions Mecaniques, on the four-cylinder compound system of Monsieur de Glehn, the directeur generale of that company. The two high-pressure cylinders (placed outside) are 14½ inches in diameter, and the two low-pressure (placed inside) 23¾ inches; each pair has a piston stroke of 25½ inches. The boiler is 14 feet 3 inches in length and 5 feet 4 inches in mean diameter. The total heating surface is 2,750 square feet of which the tubes provide 2,600 square feet and the firebox 150. The steam pressure is 213 pounds per square inch. The eight-coupled wheels are 55 inches in diameter, and there is a leading pony truck. The top of the chimney stands 14 feet above the level of the rails. The total weight of the engine in working order is 71 tons, of which the large amount of 64 tons rests on the coupled wheels.

With this powerful engine some fine work has already been accomplished and as I have been invited to inspect its working personally, I hope to be able ere long to give some account from my own observations. I learn, however, that when tried the first engine of the series took a load of 253 tons up the grades of 1.25 per cent. at average start-to-stop speeds of 22 to 25 miles an hour, and 207 tons at 12 miles an hour up the 3.3 per cent. grades.

Another piece of misdirected ingenuity, worthless patience, and wasted industry is calling for the praises of a practical world, when we fear nothing more than pity will be accorded. The performance is the constructing of the smallest engine ever made, which has been completed. It is a horizontal engine, and can stand on a 10-cent piece. One has to look through a microscope to see plainly its various parts. It runs as accurately as the best engine ever built. It is made of gold, silver, copper and steel.

It is interestingly calculated by a mechanical expert that if the 20,000 horsepower engines of the modern transatlantic liner were duplicated by human muscles of that power, three shifts of 200,000 men each, working eight hours each day, or 600,000 men total, would be required. This would give below decks a population of a city of second grade.

The Largest Geared Locomotive Ever Built.

The accompanying engraving illustrates a new Shay Patent Geared Locomotive, recently built by The Lima Locomotive & Machine Co., for The El Paso Rock Island Route.

This locomotive is the heaviest on drivers ever built, which is shown by comparison with the recent heavy locomotives built by Schenectady works of The American Locomotive Company for the A., T. & S. F. Ry., which have a weight on drivers of 232,000 lbs., whereas, the Shay locomotive has a weight on drivers of 291,000 lbs.; the weight on drivers of the Shay locomotive being also the total weight of engine and tender. The total weight of engine for the A., T. & S. F. Ry. is 259,800 lbs., and total weight of tender loaded 134,900 lbs., making a total for engine and tender of 394,700 lbs. The Shay locomotive therefore, while not the heaviest total weight, is heavier on drivers than the heaviest direct connected engine built, up to the present time.

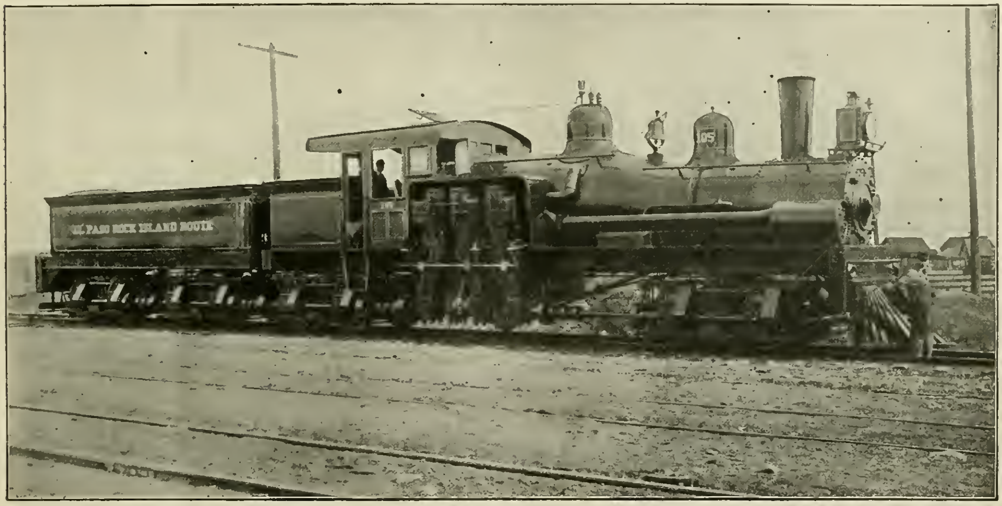
The principal features of the locomotive are as follows: It is carried on four center bearing swiveled trucks with four wheels to each truck, or a total of 16 wheels, spread over a wheel base of 57 feet 4 inches. This distribution of weight gives an average wheel weight of 18,125 lbs., and enables the engine to be used on a lighter rail and sharper curves than direct connected locomotives of equal power, having shorter wheel bases, but a much longer rigid wheel base.

As a locomotive adapted to heavy grade duty, giving a maximum of power at a minimum of cost, both as to the operating expense and repairs to engine and road bed, this engine will commend itself to motive power officials who have divisions of road with steep grades and sharp curves, and from the arrangement of its wheel base, can be safely used over light bridges where direct connected locomotives of less weight would set up destructive stresses, by reason of the fact that the most of their weight comes on a single bridge panel at one time. Since space will not permit of a more extended description of this locomotive, a table of dimensions is given for a better idea of its proportions.

GENERAL DIMENSIONS OF SHAY LOCOMOTIVE FOR EL PASO ROCK I. ROUTE.

GENERAL—

Gauge of road............. 56½ inches
Fuel used .... soft coal
Water capacity of tank.... 6,000 gallons
Coal capacity, coal bunk......... 9 tons
Working pressure of boiler..... 190 lbs.
Total wheel base, engine and tender, 57 feet 4 inches
Total length engine (boiler frame), 44 feet 5 inches
Total length engine and tender, 71 feet 9 inches
Height rail to center of boiler, 7 feet 7 inches
Height rail to top of smoke stack, 14 feet 6½ inches
Height extreme over pop valves, 14 feet 10 inches
Weight on drivers in working order, 291,000 lbs.
Weight total in working order, 291,000 lbs.
Weight of tender empty..... 62,500 lbs.



LIMA SHAY LOCOMOTIVE.

United States Coal Trade.

BY FREDERICK E. SAWARD.

A review of the coal trade shows that the United States holds first place among the nations, in the matter of coal production; this position it first attained in the year 1899, and has since increased the lead. The total for 1901, according to the figures at present available, which are very largely based upon official returns from the authorities in the several States, represented 288,927,726 net tons. This compares with a total production in Great Britain of 219,037,240 gross tons, or about 246,000,000 net tons. With France 32,301,757 metric tons, and Germany 136,010,072 metric tons. Of course a very particular item in the American production is that of anthracite coal, which by the mine inspector's report is put at 58,819,626 gross tons, of which 53,568,601 tons were shipped to market, the remainder being used at and about the collieries.

In addition to this anthracite tonnage, exclusively a Pennsylvania product, the same State sent out 82,805,578 net tons of bituminous, of which perhaps 21,000,000 tons were used for making coke. Now Pennsylvania, while an important factor in the production of the country, has by no means a monopoly of the coal deposits, for there are according to recent statistics prepared by the geological survey, something over 280,000 square miles in this country underlaid with coal, comprising as it does a product in 28 States, from the Atlantic to the Pacific coasts, and about one-half of this area is productive, or at least work is going on at some point in each of the coal-producing States within the area. The Appalachian coal field, with

which eastern people are most familiar, contains 70,000 square miles, and extends from northern Pennsylvania to northern Alabama. The western-interior and southwestern field, extends from northern Iowa to central Texas, and covers about 90,000 square miles, while the Rocky Mountain field extends from the Canadian border southeastward, and contains about 44,000 square miles. The extent of the deposits on the Pacific coast are not determined; important coal deposits are noted there from time to time, and an important district in western Washington is already a large shipper of coal. Michigan has a separate and distinct coal field, covering about 11,000 square miles, and yet the tonnage has not enlarged because of the ability to secure a ready supply and better quality of coal, from more distant points.

By far the most important of the coal-producing districts in the country are those found in Pennsylvania, Maryland and West Virginia; these are more widely known than any others and the aggregate of their production is about one-half of the entire output of bituminous coal in the Union. The hard coal tonnage is a separate feature of the trade, one of more than ordinary importance to be sure, and yet at the same time in comparing our production with that of other countries this may be laid aside for the moment, for with 223,049,000 tons of bituminous alone we are able to show a respectable total as against that of Britain, Germany or France, and any other great coal producers throughout the world.

There are 20 counties in Pennsylvania which are set down as producers of coal of the bituminous variety, with a tonnage in some instances aggregating 15,000,000 net tons annually; such as in Fayette and Westmoreland. The largest carriers of coal in this state are the Pennsylvania R. R., the Baltimore & Ohio and the Philadelphia & Reading, for the latter is doing quite a large bituminous coal trade through its connections.

Maryland is the source of supply of the best blacksmith coal in the Union; it is served by the Baltimore & Ohio and the Pennsylvania railroads, while the production of West Virginia mines, from the Fairmont, the New River and Kanawha, and the Pocahontas districts, is shipped to market over the Baltimore & Ohio, the Chesapeake & Ohio and the Norfolk & Western railroads, together with the Kanawha river slack-water navigation. This State is the most heard from of any of the sources of seaboard supply, inasmuch as from the ports of Baltimore, Newport News and Norfolk, the name of West Virginia coal has been famous throughout the world by reason of the multitude of foreign vessels taking on supplies at these ports.

The southern coal field is one of the most important in the country, embracing as it does portions of Kentucky, Tennessee, Georgia and Alabama. It practically coincides with the Cumberland plateau and its outliers, Walden Ridge, Sand Mountain, Lookout Mountain, Blount Mountain, etc., its eastern boundary facing for the most part upon the Appalachian valley, and its western boundary being like its southern margin, extremely irregular. From a breadth of about fifty miles from the Kentucky-Tennessee line, the field tapers to its narrowest point, less than thirty miles, opposite Chattanooga, and then broadens southward to eighty-five miles in northern central Alabama. The three main districts of this field are the Jellico, the Chattanooga and the Birmingham, each named from its most important town. The Jellico district, including the Jellico, the Wartburg or Brushy Mountain, and the Middlesboro basins, extends from the Emory river northward a short distance beyond the Kentucky line. The Chattanooga district, including the Sewanee, the Walden and the Lookout basins, extends from the Emory river southward a short distance beyond the Georgia and Alabama lines. The Birmingham district, including the Warrior, the Blount Mountain, the Cahaba and the Coosa basins, extends from a line connecting the southern point of Lookout Mountain and the great bend of the Tennessee river southwest to the southern limit of the coal field. Dr. Hayes does not think it probable that any important extension of the coal field as now known need be expected.

In Indiana, the cannel coal of Cannelburg, the "Indiana block coal," and the semi-block coals, lying in small basins, cover Central, Fountain and Parke counties, nearly all of Clay, western Greene, practically all of Daviess, Dubois and Spencer, the eastern portions of Pike and Warren and western Perry. Very thin between the basins, the coals attain a thickness of from three to five feet in the center of each basin. What is commonly called the bituminous field in Indiana, covers that portion of Indiana lying west of the block coal field. It is found in Vermilion, Wabash, Vigo, Sullivan, Knox, Parke, Clay, Greene, Warrick, Gibson, Vanderburg and Posey counties, in beds averaging probably six feet in thickness.

The workable coals of Illinois underlie vast areas in beds of from less than three to about ten feet in thickness, and so near the surface that in very many instances the coal is mined by stripping. Beginning with the Danville field, Vermilion county, on the northeast, these fields are north in Will county, thence west to Rock Island county, on the Mississippi river, and thence southward, embracing practically all the rest of the western, central and southern parts of the State. There remains a large area in the eastern part of the State, from Kankakee county to White (Vermilion excepted), in which the workable coal, if, as is likely, such exists, lies probably from 300 to 500 feet deep.

In western Kentucky, the coal of this field, in beds averaging probably five feet, occupies the whole or part of seven or eight counties lying in or near the angle of the Ohio and Tennessee rivers; Hopkins, Webster, McLean, Muhlenberg, Hancock, Henderson, Union. These beds lie comparatively near the surface. As compared with the average of Indiana and Illinois coal, it would appear that the Kentucky coal was richer in fixed carbon, but poorer in gas, and with a greater quantity of ash and sulphur.

The Colorado coal fields are the only ones for which a fairly accurate estimate of workable coal beds and available coal can be given. A conservative estimate places the workable beds at about 50 per cent. of the total 18,100 square miles of coal-bearing area, and the available coal at nearly 34,000,000 tons. The Colorado fields have been divided into three groups, the eastern, the Park and the western.

The coals of Wyoming, lying largely in the plains region, are of a lower grade, on the whole, than the mountain coals of Colorado and Montana. No good coking coal nor any workable anthracite has yet been found within its limits.

The coal fields of New Mexico lie chiefly in the northern part of the territory. Only those parts adjacent to railroads have been thoroughly explored. The great value of these fields is in their proximity to an extensive region in Arizona, Texas, southern California and Mexico in which very little coal of value has been found.

The areas of the coal-bearing rocks in Utah have been so little explored that the probable productive area of the State cannot be accurately estimated. The coal from the producing mines is nearly all bituminous.

Michigan is producing more coal. Coming at a time when the vast forest resources of the State must be husbanded with care, the assurance of invaluable coal deposits presents at once a very likely possibility of a great industry, to provide work for the laborer and enterprises for the capitalist. The development of the coal mines of Michigan would prove an almost invaluable auxiliary to the mining of the minerals of the upper peninsula. The importance of the facts, as set forth in this report, as bearing upon the commerce of the State, would be difficult to exaggerate. The steam-producing quality of the Michigan coal is said to be as good as that of the Mahoning and Hocking valleys.

A considerable development is reported in the States of Missouri, Kansas and Iowa. The development of the coal mining industry in this field has been determined chiefly by the location of the transportation lines. Thus, in Iowa, the Fort Dodge mining district, in Webster county, the Boone county mines, the Des Moines mines, in Polk county, the Oskaloosa mines, in Mahaska county; the mines from Ottumwa, in Wapello county, through Monroe to Cleveland, in Lucas county; the mines in Appanoose and Wayne counties and the mines in Adams, Taylor and Page counties. In Missouri,

the mines in Huntsville, Randolph county, the mines at Rich Hill, Bates county, and at Minden, Barton county; the mines in Schuyler, Putnam and Adair counties; the Lexington district, in Ray and Lafayette counties; in Kansas, the Leavenworth mines, the Cherokee coal district, in Cherokee and Crawford counties; the mines in Linn and Bourbon and Franklin and Atchison and Osage counties. These have all been determined by the main east and west railway lines and their branches, the Illinois Central, the Chicago & Northwestern, the Rock Island, the Burlington, the Wabash, the Missouri Pacific, the Missouri, Kansas & Texas and the Santa Fe.

The district comprised within the States of Arkansas and Texas, and in the Indian Territory, has shown a remarkable growth in recent years. The Indian Territory coal field is directly connected with the Kansas coal field on the north and the Arkansas field on the east. The northern part and the extreme western part are undeveloped and little known. The field includes a small part of eastern Oklahoma, the western half of the Cherokee, the whole of the Creek, and northeastern corner of the Chickasaw and the northern third of the Choctaw nation, and has an area of approximately 20,000 square miles. There are seven beds of coal in the Indian Territory coal field thick enough to be commercially workable, besides others which may be locally of workable thickness.

The Arkansas coal field runs in the basin of the Arkansas river, seventy-five miles eastward from the State line, narrowing from fifty to twenty-five miles between the southern foothills of the Boston Mountains and the northern ridges of the Ouachita Mountains. The two main beds of Arkansas coal are known as the Huntington coal, from three to six feet thick, in the western division, and the Spadra coal, between three and four feet thick, in the eastern division. The mining operations are in Sebastian, Logan, Franklin, Crawford, Johnson and Pope counties, at Jenny Lind, Hackett, Huntington, Montana, Spadra and elsewhere, and the coal produced is bituminous, semi-bituminous and semi-anthracite, good for steam, coking and domestic use.

The north Texas field extends from the south side of the Colorado river valley, between Lampasas and Concho counties, northward to Red river, in Montague county. It is nearly 250 miles in length, with an average width of about 45 miles, and has, therefore, an approximate area of 15,000 square miles. The productive portion is divided by the watershed between the Colorado and the Brazos rivers into the Brazos coal field and the Colorado coal field.

The coal fields of Montana form a nearly continuous belt extending in a northwest-southeast direction entirely across the State; but most of the fields have not been investigated in detail. As in Wyoming, the plains region east of the Rocky Mountains, extending into the Dakotas, is underlaid by beds of lignite coal of varying quality. The Bull Mountain district of 55 square miles lies in Yellowstone county about 45 miles northeast of Billings, on the Northern Pacific road. The bed is from 10 to 16 feet of lignite coal. But little coal is now mined there. The Clarks' Forks district crosses the Yellowstone 22 miles west of Billings and extends north to the Musselshell river, though without known valuable beds. Southward the beds are workable in the Big Horn basin district of Wyoming. The bed worked is from three to five feet thick and produces a good lignite coal, chiefly marketed over the Northern Pacific at Butte. The Rocky Fork district, three miles west of Clarks' Fork district, has five workable beds of coal between lignite and bituminous, excellent for domestic and steam fuel. The only mine operated is at Red Lodge, owned by the Northern Pacific, which gets from it much of its locomotive fuel.

WRECK CAUSED BY BOILER EXPLOSION.

The Pacific coast coal comes from Washington, Oregon and California, but the production is not of any moment except in Washington. Four large fields may be mentioned, the northern and the southern Puget Sound coal fields, the Roslyn basin, and the southwestern field in Lewis and Cowlitz counties. The northern Puget Sound coal field includes the coal mines of Skagit and Whatcom counties, in the northern part of the State. The southern Puget Sound field lies in King and Pierce counties in that portion of the Puget Sound basin directly east of the cities of Seattle and Tacoma. In production this is the most important field of the State, and it includes the Wilkeson-Carbonado district, in Pierce county, and

the Green river, Renton-Cedar river, and Newcastle-Issaquash districts of King county. The other field of western Washington lies about 40 miles southwest, in Lewis and Cowlitz counties. The Roslyn field is in Kittitas county, near the center of the State, and on the eastern slope of the Cascade Mountains.

An experienced engineer not long ago referred to the ordinary headlight as being of little real use when running, it merely lighting far enough ahead, that if he struck anything and lived through it, he might be able to tell in the investigation what it was.

Four-cylinder locomotives are not as modern as might be supposed. In 1826 the Wilsons, of Newcastle, built one for the Stockton and Darlington road having two cylinders for each pair of wheels. It was not a success, and a collision put it out of commission.

We recently noticed an item in press dispatches saying that an electrical experimenter somewhere had generated a sufficiently powerful current to melt the hardest steel. It is wonderful what common things may be made wonders to ordinary press dispatches. A youth must be very defective in observing habits who has reached paragraph writing age without learning that "the hardest steel" is very easily melted. Every blacksmith who forges iron and steel has to be careful not to "burn" the steel, and in that case burning is melting.

Too many seem to forget that after all is said and done, the boiler and cylinders are what count, rather than the number of drivers or trailing wheels. The boiler is what counts in persistent running.

The Roasting Hot Box.

BY SHANDY MAGUIRE.

Thinking that a few minutes I have at my disposal can be well employed giving some experiences I passed through, which "made my hair lift," metaphorically speaking, I beg to state the following true tale:

Less than a score of moons ago I had an epidemic of hot boxes. The first one simply got a gait on me to do a little talking to the galvanizer. The second one got me to talk more. The next train which arrived at this end of the pike brought in another hot box, making three in as many trips; also a letter calling my attention to No. 1, with the admonition to "get after this vigorously, and do not let it occur again." I read that brief sentence as many times as a young fellow in his teens ever read the tender admission of a mutual feeling in the breast of his first love, but, oh! with how different a sensation. Well, my tongue ran hot as well as the box; and in reply to my conversation, I was informed to play galvanizer myself, to see if I could do any better. I accepted the invitation, rolled up my sleeves and got to work. I have had a little experience in my day with hot boxes, so I bent every energy to repacking the contumacious cuss that was looming up before me in my dreams at night. Out went the car again, with a half gallon of oil to the trainman, and "three for a quarter," to keep an eye on it till his return. I wanted to obey the admonition "don't let this happen again," and also to let the galvanizer see that I was a better man than he.

In came that coach next morning, and as I looked into the trainman's eyes, it was with the same sort of a sinking dead gone feeling a felon is supposed to look at the foreman of the jury, on his return from the juryroom, accompanied by his associates, before he speaks. The trainman's reply was laconic enough. Here it is, "Hot as hell!"

"Angels and ministers of grace defend us," thought I. I was not able to speak it. "Any mail?" I faltered. "Yes, there's a Scranton letter in the car." Sure enough, there was. That letter was an inquiry regarding hot box No. 2, and two more yet to be heard from. I got tired of the "three for a quarter" business, and thought I'd get away from modern methods of packing boxes to the habit of the days that had gone by, when the engine I was running was taken care of by myself. I sent the coach out again, after putting a bar of brown soap where it was supposed to do the most good. It came back blooming hot. "Now in the name of all the gods at once" what am I to do? I thought of the old experience of when the soap failed, how I bought a bag of salt, and when the salt failed, how I chucked in the bag, and so on, and so on. I could see no way out; and hot boxes three and four yet to be heard from, with the compliments of the M. C. B.

In the days of my youth, a good mother intended I should grow up a model of manly virtue and sanctity. She kept me very close to the church. I was thoroughly conversant with the rubrics of religion. The good Father took care of me also. He watched over my spiritual weal. For any infraction of God's law my penance was the Litany of the Saints twice a year—six months each time. I was well acquainted with all the saints in the calendar. I knew what each one was the patron of; but amongst them all, there was not one to take a hot box unfortunate under his or her protection. Had there been, I

GREAT HORSESHOE, NEW RIVER CANON ON CHESAPEAKE & OHIO RAILWAY.

would have become a devotee, and prostrated myself before the shrine, supplicating intercession in my behalf, to save me from annihilation.

Before hot box No. 5 arrived, inquiry regarding box No. 3 came duly to hand. Attached to the M. C. B.'s letter was a letter from the foreman of the first station from me, answering an inquiry of the cause of so many hot boxes in train so and so passing his station. It said: "Everything looks O. K. It must be negligence at Oswego." "The devil damn thee black, thou cream faced loon," I said, when I read it, and at that particular moment I would have assisted to blacken him, had he been close at hand.

In came box No. 5, smoking as freely as a sand-dryer's chimney. Well, I didn't drop dead. On the contrary, I began to get used to it, like the man hanging. I said to the galvanizer: "We'll take out that pair of wheels." He replied: "It's about time." The straight edge was applied to the journal. Nothing showed up wrong. The gauge was put on the wheels, the same results. There was no indication of anything to cause the trouble that could be discovered, unless the X-ray might discern a demon inside the journal, and I had no X-ray to apply. I examined the dust-guard. It was apparently in good shape. I remembered that hail is formed by the moisture of the atmosphere attaching itself to a molecule of dust, when conditions are favorable above our heads; but I didn't see any opportunity for dust to play a prominent part in the box, and I also thought of the time I used dust on a cut tank journal with good results, and without the knowledge of the master mechanic. I then gave "personal attention" to the truck. If it had been standing north and south I noticed from the northwest of me, supposing I was standing on the center casting, a very bright appearance of the underneath part of the equalizing lever where it rested on the box. "I wonder," thought I, "if I am on the right track this time, or am I growing mad nor' nor' west?" The side bearing, on the same side of truck hot box was on, showed a polished surface also. The bolster spring did not measure within 5/8 of an inch what the other three bolster springs did. I applied a new bolster spring; reduced the side-bearing block 3/8 of an inch, put in the same pair of wheels again, packed the box myself, gave the trainman a dime to buy a plug of "Navy Sweet," and washed my hands, just in time to take a Scranton letter from the train-mail distributer. I felt it in my bones that there was some vinegar and gall inside. I reconciled myself with the knowledge that it was not the first time the vinegar and gall was administered to one laboring in a good cause, and tore open the envelope. "Farewell, a long farewell to all my glory," I ejaculated as I read that letter, which concluded with this admonition: "This business must immediately stop." I merely murmured "God grant it may."

The night of that day, in this town, there was lying dead an honest old citizen "who had done nothing worse than to die." I went to the wake, determined to sit up all night, with a few kindred souls, to pay our respects to the deceased, and his living relatives, and also, on my part, to await the return of the coach, to see if on its arrival I would find myself as dead as my friend on his bier or not. The hours tripped by on winged feet. We talked reminiscently and pleasantly of the poor fellow gathered in, and forever done with the daily damnation of a railroading life. There were more than one of our squad in the corner ready and willing to console the widow every burst of grief she'd sob uncontrollably with; and whisper to her of happier days to come. In the intensity of one of her gushes of anguish she screamed out audibly: "Jack, darlint, I wonder who'll be the next to go." "I'll be able to answer that question when train 909 comes in," I whispered to my partner on my right. "Oh wirra, wirra," she cried "but it was you, darlint, that always took good care of me." I wondered how he'd make out trying to get down a hot box. "I wish it was meself that was goin' to me grave instead of you this blessed mornin'," she again sobbed. "That's a blooming lie," said Tom Purdy to us, and we grinned acquiescence.

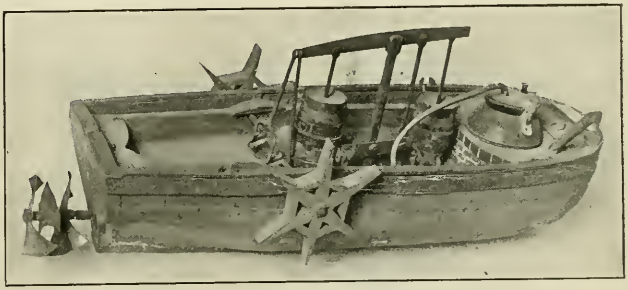
"Night's candles were burned out," and we took our leave of the poor disconsolate widow in a tender manner.

The train came in on time. It no sooner stopped than my hand was on the box, which I found cool. The trainman had arrived to where I stood by this time, and he said: "It ran bothersome all the way out, but I kept close watch of it, and got it down for you all right by the time we arrived at Binghamton. Give us a quarter to get a shave." I felt so delighted with the results, that I went round with the hat and gathered shekels enough to purchase a wreath of beautiful flowers, which I placed on the breast of poor Jack Reynolds, and won the everlasting thanks of his buxom widow, who smiled sweetly through her tears at the delightful way her dear departed was going to the grave, all covered with forget-me-nots and roses.

Plans and specifications have been prepared for a new locomotive shop for the Great Northern R. R. in St. Paul. These are reported to be modern in every way and some of the buildings are already under construction.

According to recent reports there are about 225 locomotives in operation on the railways of Norway.

The fires which have too often resulted from the dining car stoves or ranges are said to be absolutely out of the question with the Stearnes steel range. This has a top and covers which lock automatically and prevent fire being scattered in case of accident. These ranges are used by every road running out of Chicago and many in other parts of the country.



MODEL OF JOHN FITCH'S STEAMBOAT—1785.

The First Steamboat?

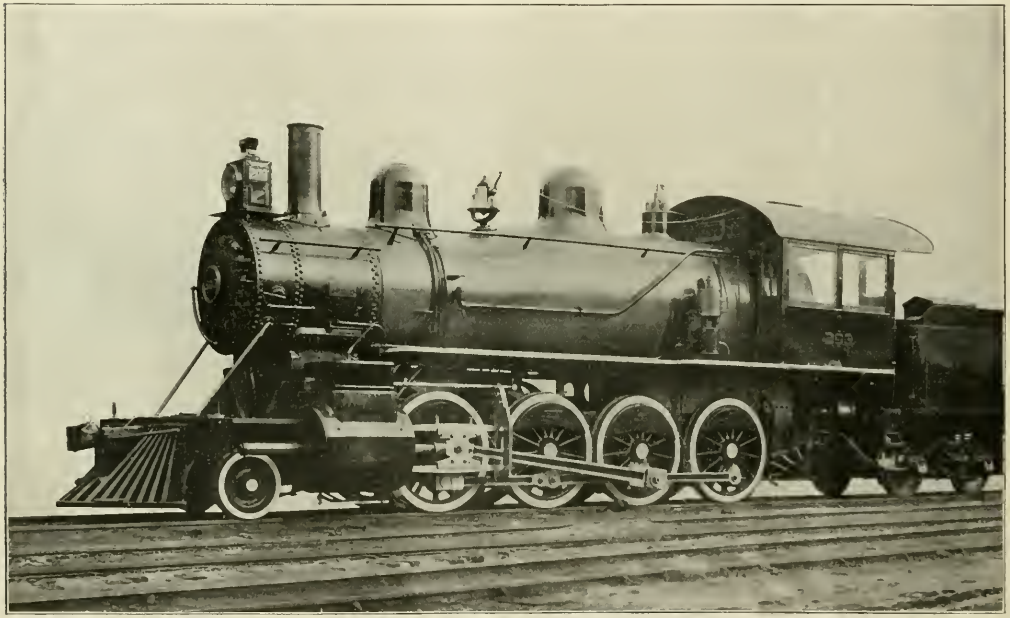
What was probably the first steamboat was built by John Fitch and is shown with this. It was only 4 feet long and at first only had paddle wheels. This was run in a pond near Davisville, Bucks county, Pa., in 1785. Five years later, 1790, he fitted a boat with steam-driven oars and ran i on the Delaware river near Philadelphia.

The photograph is from a 26-inch model of a yawl which ran with a screw on Collect Pond, New York city, in 1797. The construction can be seen from the photograph and is of course very crude and open to criticism, but the boat ran and John Fitch deserves much more credit than he receives from the world at large.

In the popular mind everything in steam engines is due to Watt, in steamboats to Fulton, in locomotives to Stephenson, and in electricity to Edison. Needless to say —and without detracting a particle from the true fame of each—they are all wrong.

Compound Consolidation for the Wheeling and Lake Erie.

The Wheeling & Lake Erie has recently received some compound consolidation engines from the Pittsburg shops of the American Locomotive Co. The cylinders are 22 and 33 by 28 inches, the low pressure cylinder being on the right side. The boiler is of the extended wagon top type, having a diameter of 60 inches at the front sheet. The gusset sheet is placed forward of the dome and the diameter of the boiler at the throat sheet is 70⅛ inches, which gives ample steam space. A noticeable feature about the spring rigging is that a half elliptic spring at the rear of the whole system replaces the usual hellical spring at that point. This is not new practice by any means, it is a revival of a long-ago method of arranging spring rigging. All the driving wheels are flanged, and are 57 inches in diameter. The tractive power of these engines is 35,000 pounds. The total weight is 251,700 pounds. Some of the principal dimensions are as follows:



WHEELING & LAKE ERIE CONSOLIDATION.

GENERAL DESCRIPTION.

Type	Compound Consolidation
Weight on drivers	146,300 lbs.
" " truck wheels	21,100 "
" " total	167,400 "
" of tender, loaded	84,300 "
" total of engine and tender	251,700 "
Tractive power	35,000 "

DIMENSIONS.

Wheel base, total of engine	23 ft.	10 in.
" " driving	15 "	8 "
" " total of engine and tender	52 "	3⅛ "
Length over all, engine	38 ft.	6⅞ in.
" " " total, engine and tender	62 "	6 "
Height of stack above rails	14 "	10 "
Heating surface, firebox	159 sq. ft.	
" " tubes	1,849 " "	
" " total	2,008 " "	
Grate area	30 " "	

WHEELS AND JOURNALS.

Drivers, diameter	57 in.
Truck wheels, diameter	30 "
Journals, driving	8 x 11 "
" engine truck	5½ x 10 "
Main crank pin, size	6¾ x 7 "

CYLINDERS.

Cylinders, diameter	22 & 33 in.
Pistons, stroke	28 "
" rods, diameter	4 "
Main rod, length, center to center	123 "

	H. P.	L. P.
Steam ports, length	18 in.	21 in.
" " width	1⅜ "	2 "
Exhaust ports, length	18 "	21 "
" " width	3 "	3½ "
Bridge, width		1½ "

VALVES.

Type .... Richardson balanced

	H. P.	L. P.
Greatest travel	5 in.	6 in.
Outside lap	1 "	¾ "
Inside clearance	3/8 "	½ "
Lead in full gear	1/16 "	3/32 "

BOILER.

Type	Extended wagon top
Steam test	220 lbs.
Working pressure	200 "
Material in barrel	steel
" " " thickness	11/16 in.
Diameter of barrel at front sheet	60 "
" " " " throat "	70⅛ "
" at backhead	70⅛ "

Seams; horizontal, butt joint, double welted, sextuple riveted.

Seams; circumferential, doubly riveted.

Thickness of tube sheet	½ in.
Dome, diameter	30 "
Safety valves	Three 3 in. pops.
Crown sheet supported by radial stays	1⅛ in. dia.

TUBES.

Number	260
Outside diameter	2 in
Length over tube sheet	13 ft. 8 in.
Material	iron

FIREBOX.

Length	108 in.
Width	40¼ "
Depth at front end	67¾ "
" " back "	64½ "
Material	steel
Thickness of sheets, crown	7/16 in.
" " " sides & back	⅜ "
" " " tube	½ "
Water space; width; front, sides & back	4 in

SMOKEBOX.

Diameter	61½ in.
Length from tube sheet to end	64¾ "

OTHER PARTS.

Exhaust nozzle, diameter	5¾ in.
" "	1½ in. below center line
Smoke stack, least diameter	15 in.
" " greatest "	16 "
" " height above smoke box	45 "
Track sander	pneumatic
Power brakes	Westinghouse-American

TENDER.

Type	eight wheeled with swiveled trucks
Tank, capacity, water	4,000 gallons
" " coal	8 tons

Type of truck: Diamond; American Steel Fdy. Co.'s bolster.

Type of back drawhead: M. C. B. coupler and Westinghouse friction draft gear.

Tender truck springs .... Double Elliptic

General Correspondence.

Why Large Locomotives Lack Economical Efficiency.

BY F. P. ROESCH.

Some time ago I had the good fortune to obtain possession of a small pamphlet, written by Prof. W. F. M. Goss—who needs no further introduction—entitled "Notes Concerning the Performance of the Purdee Locomotive, Schenectady," a careful study of which gave me an insight into a problem in mechanics which had always been a puzzle, and consequently a source of continuous worry to me—because I could not hit upon the proper solution—viz., The relative efficiency of large and small locomotives on comparatively level grades.

Upon learning the theory as advanced by Prof. Goss, I proceeded to prove the same as far as possible, in actual road tests, at every opportunity, until convinced that it was practically correct for all locomotives as stated.

Upon the publication of the comparitive tests on the Illinois Central Railroad the same problem was again prominently brought out, so I determined to bring the matter before the readers of Railway and Locomotive Engineering, believing it to be a question of vital interest, and also to learn if others had noticed the same apparent discrepancy in the power developed and utilized by the two types of locomotives, and to invite discussion to obtain their version or solution of the question involved.

I fear, however, that the problem has either been passed unnoticed by many, or they are in the same position I was in before receiving the light referred to, and as some have admitted, viz., puzzled, and therefore have nothing to say.

I will therefore give what I believe to be the correct explanation, based on Prof. Goss' critical speed theory, and proven, to my personal satisfaction at least, by actual road tests.

THE SOLUTION.

In experiments with the locomotive "Schenectady" at Purdue, Prof. Goss proved conclusively that there is a point where the power of the locomotive no longer increases with the speed. We will quote from Prof. Goss direct. In paragraph 4, entitled Power and Speed, in the "Notes" referred to, he says:

"In general the power of an engine is proportional to its speed, that is, if the speed is doubled, all other conditions remaining the same, the power is doubled. This general relation must, of course, exist to a locomotive, but in this particular type of machine it is not possible to change the speed and maintain all other conditions constant. In fact when speed is changed, a number of other factors insist upon changing also: and herein lies the chief difficulty which must be met by all who enter upon an analytical study of locomotive performance."

"An important factor which is affected by a change of speed is the steam distribution in the cylinder, arising from the changed time interval during which steam must enter and leave the cylinder. It is evident that a higher speed must result in an increase of power excepting under conditions which make the loss of mean effective pressure equal to, or greater than, the gain in speed; that is excepting where the loss in the amount of work per revolution is equal to or greater than the gain in the number of revolutions, * * * thus, for a cut-off of 6 inches the mean effective pressure is reduced from 43.5 pounds at 15 miles per hour, to 18.3 pounds for the same cut-off at 55 miles per hour."

It will be seen by the above that the power of the locomotive is directly affected by the speed of the valve and piston, and as the speed of piston and valve is governed primarily by the diameter of the drivers, we can readily see that a locomotive can easily be "killed" for certain work, by having the drivers too small for the work required.

Quoting again from Prof. Goss: "The boiler is most efficient when working under its lowest power, while the engine is most efficient while working at its maximum power. The efficiency of the two combined is highest somewhere between the limits of the power developed at 35 and at 15 miles per hour. . . . Prof. Goss is speaking of Purdue engine "Schenectady." . . . It has been shown that with the throttle fully open and the cut-off constant, the power of the locomotive increases as the speed is increased up to a certain point, after which the power does not increase even though the speed is increased. I have called that point on the scale, where the power ceases to increase, the critical speed. * * * It is an interesting fact that the steam consumption per horse power per hour is lowest when the engine is running at its critical speed and equally interesting is the fact that the coal consumption per horse power per hour is practically constant for all points below the critical speed. These relationships are of such a character as to make it appear probable that they will be found true for all locomotives, in which case the critical speed becomes an important factor to be considered by the designer of locomotives. For the locomotive tested, the critical speed is about 35 miles per hour," etc.

That the conclusions arrived at by Prof Goss are practically correct, and apply to all locomotives, with few modifications, will not be denied by any practical locomotive engineer; any engineer who has run one certain engine for any length of time can tell you the point of relationship between the speed and cut-off of his engine, where the locomotive will perform the maximum of work on a minimum of coal and water, over every portion of the road, according to variations in grade.

This is Prof. Goss' critical speed, and can only be determined on the various locomotives by careful tests, but assuming the factors as found for Purdue locomotive "Schenectady," as approximately correct for all locomotives, basing same on the piston speed per minute, we will apply these factors to engines 35 and 639 tested on the I. C. R. R. and see how we come out.

With engine "Schenectady" it was found that the combined efficiency of the boiler and locomotive was somewhere between the limits of 15 and 35 miles per hour; taking the mean between these two figures we have 25 miles per hour, which I believe Prof. Goss will admit to be practically correct for average road service, under all conditions.

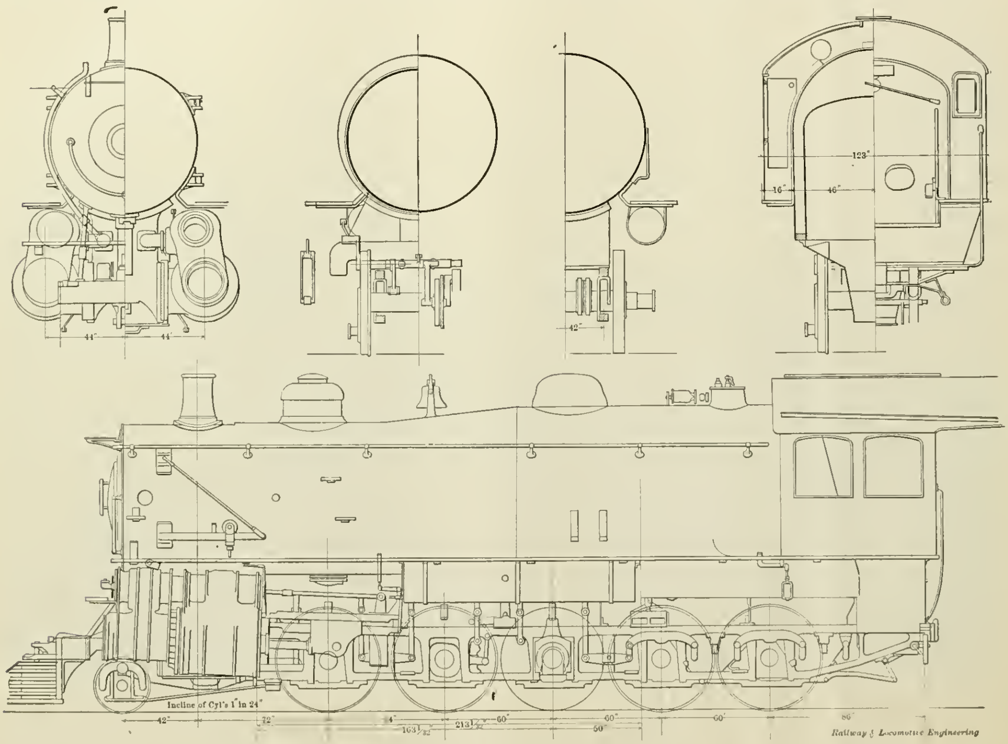
At the rate of 25 miles per hour we find the piston speed of engine "Schenectady" to be 532.5 feet per minute. The equivalent for this speed in engines 35 and 639 is found when running at the rate of 21.38 and 18.05 miles per hour respectively. From this it would appear that both engines 35 and 639 had reached their critical speed and that any further increase in speed must necessarily result in a loss of power and a consequent reduction of tonnage in train. This no doubt would apply to engine 35, but from the fact that engine 639 with but 76% of theoretical rating as applied to engine 35, shows but an average speed of 17.71 miles per hour, would lead us to believe that this engine had already attained and passed the point of critical speed, which in all probabilities was the case.

There are several causes which might all contribute toward this actual falling off to below the theoretical critical speed, but which could be easier and more conclusively determined by means of indicator and dynomometer tests than by simple theoretical deductions; however, the fact remains that engine 639 was not loaded to the most economical rating, nor handled at the most economical

speed, but that a large percentage of her theoretical tractive power was absorbed in the engine itself.

In order to prove this assertion, let us see the difference in the amounts of tractive power exerted by each locomotive per ton of freight moved, including the weight of each engine and tender. We will again rate engine 35 as 100%.

Eliminating the speed entirely, we have $\frac{T}{w+t} = P$. In which T = tractive power, in pounds w = weight of engine and tender, in tons t = tons in train, and P = pounds tractive power to move one ton.



DETAILS OF BALDWIN TANDEM—SEE PAGE 271 OF MAY NUMBER.

Substituting known valves, we have for engine 35 $\frac{25,600}{129+1076} = 21.24$, and for engine 639, $\frac{46,770}{154+1517} = 27.98$, showing that it required $27.98 - 21.24 = 6.74$ pounds more tractive force to move each ton in the trains hauled by engine 639, than in those hauled by engine 35.

Now what became of this extra 6.74 pounds of tractive power?

Surely no one could have the temerity to claim that an increase of 36% in the length of the train—especially when 46% of the total increase consisted of empties—would result in an increased resistance of 31.73%.

Neither could we claim that engine 639 had all hard pulling trains; while engine 35 had all easy ones; nor that the tractive power exerted by engine 35 was stronger than that of engine 639. Neither could we well claim that engine 35 used a greater per cent. of the theoretical tractive power than engine 639, for if engine 639 did not use the same per cent., that is, if it was there to spare, but simply not used, why was it not, when it was in competitive test? At least why was not enough of it used to at least haul the trains at the same speed as made by engine 35? There is little need of building locomotives with more tractive power if we don't intend to use it.

No. In my opinion none of the above mentioned excuses are tenable. There is but one plausible explanation, and that is that the critical speed of engine 639 was so low, that the speed of train could not be accelerated enough through sags or on the higher grades to carry it over the harder pulls, same as was possible with engine 35. In other words, that the greater part of this extra power, or 24% of the total tractive force required to haul each ton of freight by engine 639 was absorbed in the locomotive itself.

This loss is certainly something enormous, especially when we take into consideration that we made no deduction whatever for internal friction in engine 35, neither did we make any allowance for the increase in resistance which must necessarily follow an increase in speed from 17.71 to 20.24 miles per hour.

All this goes to prove that at 17.71 miles per hour engine 639 had already passed her point of critical speed, or point of fullest economical operation.

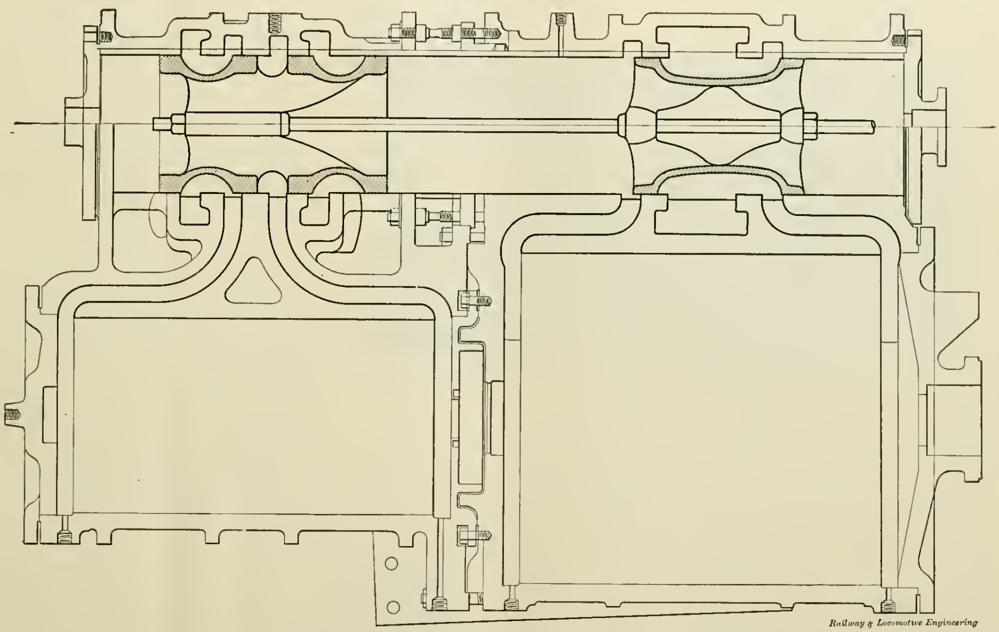
There is no doubt but what for a very short distance this speed could have been exceeded with this tonnage, but we question very much if it could have been maintained even for a distance of 25 miles without some change in the front end draft which undoubtedly would have resulted in quite an increase in the amount of fuel consumed; as an increased speed with the same tonnage, would necessitate an increased length of cut-off, which in turn would require more steam and consequently more coal. The fact that the average speed was but 17.71 miles per hour, would seem to imply that the boiler, large as it is, was not adequate to supply an increased demand for steam.

This fact is also commented upon by Prof. Goss in the "Notes" before quoted, in which he states, page 2, "An attempt to lengthen the cut-off beyond the limits for which results are given in table I, failed through lack of steam. The 10-inch cut-off test at 35 miles per hour was successfully run only after the double exhaust nozzle had been reduced from 3 inches diameter to 2¾ inches diameter."

In some extensive road tests conducted by the writer with 22x28-inch consolidation locomotives, 57-inch wheel, it was found that in order to accelerate and maintain the speed on a 1% grade, attempt to accelerate to and maintain a higher speed, without a corresponding reduction in train tonnage, or to haul an increased tonnage at the same speed, requiring a longer cut-off, and of course an increased steam consumption, soon met with as decided a reduction in boiler pressure as we previously met with in M. E. P. or cylinder pressure, notwithstanding the fact that these engines had by far a more liberal heating surface than the average up-to-date locomotive, that the coal was first class, and the engines were properly fired.

The point nearest where the all important factors balanced, that is, the was from 22 to 25 miles per hour or more, that a locomotive having 9,000 pounds less tractive power, but a correspondingly slower piston speed (larger drivers) could haul almost the same tonnage as the consolidations before mentioned, and with much less coal, all of which goes to prove the intimate relation that must exist between the speed desired and the general locomotive dimensions, or to quote again from Prof. Goss, "In designing locomotives for any given grade, the critical speed is one of the vital points that deserve serious consideration."

In conclusion we wish to emphasize



CYLINDERS AND VALVES OF BALDWIN TANDEM—SEE PAGE 2?4 OF MAY NUMBER.

from 10 to 22 miles per hour, it was necessary to reduce the tonnage behind the locomotive 37.5%; while with a 20x24-inch ten-wheeler, 63-inch wheel, it was found necessary to reduce the tonnage but 13.67% to accelerate from 12 to 25 miles per hour.

The relationship between cylinder volume feet per minute, and port opening, that is, the volume of cylinder to be filled through a given opening in a given time, was plainly brought out by the indicator, which also helped materially to determine the point of critical speed.

With an increase in speed it was found necessary to shorten the cut-off, which in turn showed a very sudden drop in the admission line, a decided reduction in M. E. P., and of course a corresponding effect on indicated horse power. Any highest speed at which we could handle the most tonnage on the lowest consumption of fuel per ton mile, we fixed upon as the most economical speed for this (consolidation) type of engine on this district—ruling grade 1%—which we found embraced between the limits of 13.5 and 15.8 miles per hour, according to weather conditions, etc., and which we found could be obtained by a reduction of 10% of train tonnage from the maximum or "drag" rating. Any marked deviation from the factors thus found, in either direction, either by increasing the tonnage and decreasing the speed, or decreasing the tonnage to increase the speed, resulted in an increase in coal consumption per ton mile, and consequently in a loss in operation.

We also found when the speed desired some of the points brought out in Prof. Goss' article, and which are continually being proven in actual road practice, by making a few predictions.

LOCOMOTIVES OF THE FUTURE.

It takes no far glance into the future to see that railroading in all departments will soon be reduced to an exact science. Locomotives will no longer be ordered indiscriminately for any road or for all districts of one road, as in the past.

Mechanical men are waking up to the fact that because a certain type of locomotive gave excellent results in Florida or some other level country, it can not be accepted as a criterion of equally good performance in mountainous districts, or on roads where grades run from 1 to 4%. Consequently we feel perfectly safe in

prophesying that the near future will see a gradual breaking away from established standards, and the dawning of an era when every particular order for new power will be of a type especially designed for the district on which it is to be operated, and the service for which it is intended; when it will no longer be a question of what type of locomotive will handle the greatest tonnage, but what type will prove the most economical for the service required.

It is not always the most powerful locomotive that proves the most economical, as, in order to obtain great power, with our present limitations of gauge, etc., the powerful locomotive must necessarily have small drivers and long stroke, consequently, as explained above, the critical speed of this type will fall so low that it could only be operated at a loss on districts where trains are frequent and time is fast, or on practically level roads where the possible train behind one of these modern heavy locomotives would be of such a length as to make it difficult for two or more trains to meet and pass at the average siding without the delays of sawing, etc. For these reasons we feel perfectly safe in saying that it is only a question of time when the large consolidations are relegated to those roads where grades exceed 1%, while freight trains on the more level roads will be handled by perhaps slightly less powerful but much more speedy locomotives, as with the continual increase in traffic it will soon be seen that time is an important factor as well as tonnage.

Denver, Col.

Counterbored Flue Sheets.

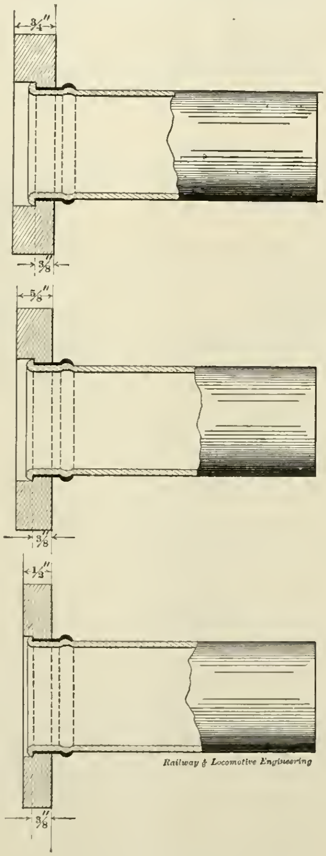
I am sending you a blue print showing a patent I have taken out on flue sheet for steam boilers. Patent consists of the counter boring of the flue holes in sheets. Owing to the increased pressure now carried on boilers, it has become necessary to use heavier flue sheets than when we were carrying a lighter pressure. By the method of counter boring we decrease the amount of flue that is exposed to the heat not protected by water.

The blue print shows the different thickness of flue sheet, namely: ½ inch, ⅝ and ¾. In fact we can use any thickness of flue sheet wanted by simply deepening the counter boring to any given dimensions desired. I have quite a number of engines running with flue sheets with the dimensions given above or shown on blue print, with good results. Also claim for the device that it is a protection of the bead from the intense heat and cinders.

There has been a great deal said and written in reference to the using of heavy flue sheets in the protecting of flues. This device will overcome any difficulty that has arisen by the introduction of heavy flue sheets.

C. F. Lape.

San Bernardino, Cal.



LAPE'S PATENT COUNTER-BORED FLUE SHEET.

Mechanical Index.

Section A of the Mechanical Index, comprising machine tools and metal working machinery, has just been issued by the Industrial Press of New York. The book is divided into eight departments, dealing with bicycle machinery, blacksmiths' tools and appliances, bolt and nut machinery, machine tools, machine tool accessories, machinists' small tools, metal working machinery and wire making and wire working machine and tools. The general index is printed in English, German and Spanish, and the classified index of English.

The American Steam Gage and Valve Mfg. Company, Boston, make a specialty of testing and repairing gages of all kinds and makes. The name of the makers guarantees that the work will be well done.

Locomotive Firing.

Second Paper.

BY T. J. HOSKINS.

BAD FIRING.

A bad fireman will jerk open the door to admit fuel just about at the time when the fire has begun to get at its best. He will admit five, six or seven scoops of coal as his fancy may dictate never looking to see where the fire is lightest then slam the door with a deafening noise and lean out to watch the stack—and well he may. While he held open the door the air cooled the arch the fresh coal covered the carbons lying on the grates so that their heat was momentarily lost to the fire-box and the air passages were obstructed. He has neither the temperature nor the air necessary to the consumption of the fuel. One who continues such a practice is a hopelessly bad fireman.

GOOD FIRING.

The fireman should try to reach his engine in time to do his work without hurry. He should ascertain the water level and steam pressure, and in arranging the fire should consider the time he has before leaving. When it is necessary to stir down the fire the blower should be started lightly, and if there is a large bank, only a portion will be knocked down at first, and when the fire has burned sufficiently to prevent a cloud of smoke, the bank may be further leveled. Before starting, the fire should be heavy enough not to be torn to pieces and in proper condition for the admission of fuel. The fire should be fed until there is a strong red flame, then the door should be closed and the fire allowed to burn until it is white, when the work of steady firing should begin. More than one or two shovels of coal should not be admitted at each firing, and they should be scattered over the whitest portions of the fire.

CROSS FIRING.

Cross firing as a system or method has many good points. The rule is to fire with one shovel of coal in one corner of the fire-box and then with the next one in the opposite corner, always placing the last shovel of coal in a different region from the former. This enables the fireman to carry a level fire and always leaves a portion of the fire without fresh fuel. The gases rising from the shovel of coal just admitted will chance to come in contact with gases from another region of the fire-box which is hot enough to ignite them. In this practice the fireman must not forget to observe the color of the fire before admitting the coal, as the engine might be burning too much coal in front or at the door, in which case there would soon be a bank.

THE BRICK ARCH.

So many firemen have been mortified by an engine suddenly failing for steam, and placing the poker in the fire have found a bank against the arch or a hole under

it, often a bank and a hole beyond it, that they have failed to inform themselves as to its possible benefits and can see nothing in the brick arch but an encumbrance designed to harass and torment them; but, in fact, it has a high place in the list of appurtenances aiding combustion. If a shovelful of coal be placed in the fire-box the gases arise and move away in a column, and unless they are disturbed in their journey will enter the flues without having touched a temperature high enough to ignite them, only as they are encroached upon at the edges of the column, by the flames from the uncooled regions of the fire-box. If an arch be placed in an engine it will remain steadily at a temperature approaching that of the hottest flames and being inserted in the path of the gases they will be in part borne against it and will thus be ignited. Failing to touch the arch the reduced space above and below naturally forces them into close relation. After passing the arch they incline upward and downward and rush together in the receptacle behind it. Besides its aid to combustion it prevents the rush of cold air into the flues and may be turned to excellent account by the skilful fireman.

FIRING DIFFERENT ENGINES.

The work that keeps one engine hot may not be effectual on another engine; nevertheless, a fireman must not always conclude that because an engine don't steam she won't steam. When an engine is fitted with a small nozzle and open grates the draft is usually powerful enough to tear down any piles that may be reared or to shred any amount of coal that may be admitted, but once a nozzle of proper dimensions is fitted in the engine and the fireman finds maintaining steam easy. Sometimes when a fireman has been firing for a "slugger" and an extra man is put on the run, the fireman fails to adjust his work to the needs of the nicely worked engine and there is trouble for steam. In a compound engine the draft is more mild and greater attention is required to keep the fire in proper condition. If the fireman thoroughly comprehends that the work in the fire-box is the combining of the atoms of carbon and hydrogen from the coal with those of oxygen from the air, and will be careful about the color assumed by the blaze, he may be assured that one rule holds always. It is best to keep up the fire as heavy as possible with a white blaze, admit small quantities of coal at a time and never fire upon a clouded spot or where fresh coal can be seen. By carefully attending to these matters and watching the fire to see that there are no holes or banks and that clinkers do not obstruct the passage of air through the grates anyone may become a skilful fireman with gas coal.

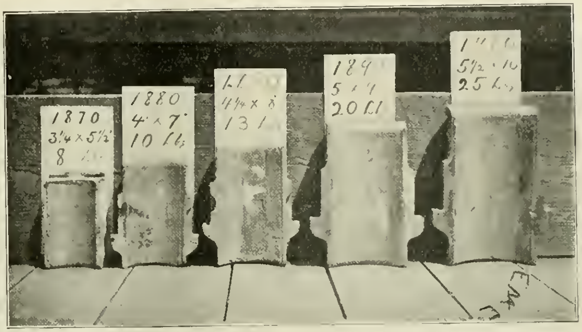
DISEASES OF THE FIRE.

Often the fireman may look into the fire and see the carbons lying on the grates and but little or no blaze rising from them; at that point the fire is too light. In an engine with long fire-box the fire near the door begins to jump and the gases are rising thick and muddy towards the front; there is a bank under the arch. Suddenly the engine fails of steam, the fire is level but seems to have lost the briskness with which it burned before; the blaze is red and coal admitted lies for a time without being consumed; there is a hole in front. In a deep fire-box the blaze leans away from the door, and in the intervening space there are seen little glowing particles like golden fly wings; there is a hole under the door. If the fire suddenly ceases to burn and there is nothing wrong in the fire-box, the dampers may have fallen down, the front is full of sparks or the netting stopped. When the engine arrives at a station or water tank and on examining some portions of the fire are made up of a pile of sparks a little higher than the other and appearing much cooler, perhaps admitting a blue or discolored blaze, it indicates a clinker. The same may be distinguished when engine is working by the appearance of the sparks and by the fire heaving up around the edge of the clinker. The fire may be relieved some by taking the hook and breaking or setting the clinker on edge. At the first opportunity the fire should be allowed to cool down and the clinker removed.

Evolution of the Car Brass.

During the past few years a great deal has been said and written in regard to the increased size and capacity of railway freight equipment. A person passing through a railroad car shop can get no better object lesson than in the increased size of journals and brass bearings. The enclosed will show the evolution of car brasses for 30 years on the Central and Southern Pacific.

H. Englebright,
Master Car Repairer,
Oakland, Cal. Southern Pacific Company.



EVOLUTION OF CAR BRASSES.

Setting Wedges.

Properly fitted main driving boxes and main wedges are what really constitute the foundation of a "smooth-working engine," and if the foundation be solid, ordinary defects in the fitting of other boxes, and the adjustment of other wedges, will, as a rule, pass unnoticed, when the same condition existing in the main boxes or wedges, would cause a very poor working engine, and the life of side rods, straps, pins, as well as tire, is influenced largely by the condition of main boxes and setting of main wedges.

The word main as applied here, means all that it can imply wherever used, for the main rods, jaws, boxes and main tires represent the chief agents through which steam energy is transmitted to the main working parts, so as to develop the tractive power of engine, and it naturally follows that, in the proper fitting and adjustment of these parts, the smooth working of an engine depends.

How tight should main wedges be set? They should be set loose enough to properly feed oil down between it and the shoe and wedge, and tight enough to prevent pounding in a properly fitted driving box, and when that position is once found, there that wedge should be kept by being adjusted as often as wear will permit its being moved, even a quarter turn of the wedge bolt. Don't wait until "she pounds" before setting the wedges, set them regularly, or whenever you think the wear sufficient to enable their being moved the distance already stated, and this practice will prolong the life of the box, as well as all other related parts.

Other wedges should not be run as "tight" as the main wedges, and this rule applies to any and all locomotives of whatever design.

The chief source of trouble with a wedge comes from not knowing "where it is." Working by guess. Setting it up a little now and then until it perhaps sticks, then pulling it away down, then

moving it up again a little at a time until it sticks once more, which practice soon puts it in such condition that it is difficult to tell, by the riding of the engine, whether it is stuck or not. The sticking point may be found, excepting in odd cases, without taking that risk. Each time the wedge is adjusted it should be first moved as high as it will go, to ascertain the extent of wear, then it should be drawn down the distance experience has taught proper, and that rule should govern in setting the wedges at all times, while the knocks, jars and pounds, which are bound to develop with service, should be taken as a matter of course.

The wedge should be used as a preventative and not as a remedy.

THOS. P. WHELAN.

Bellevue, Ohio.

Repairing Reservoir Rolling Stock.

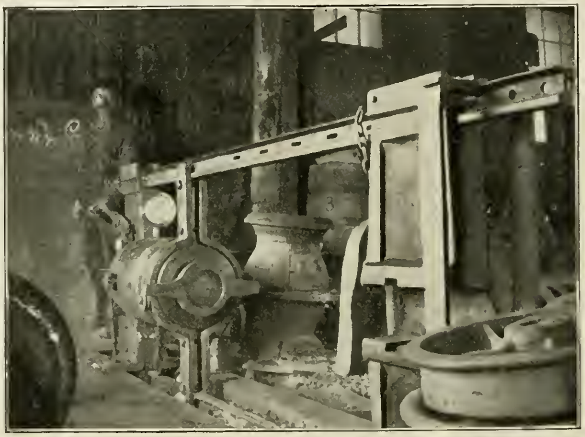
The accompanying illustration shows hydraulic wheel press designed and built at the Nawn & Brock repair shop in the Wauchusett Reservoir. We have a system of water works with nearly 50 pounds pressure in the pipes supplied from a large storage tank at 100 feet elevation, so we get almost 50 pounds pressure to the square inch on the ram of the press. The additional pressure is easily furnished with the hand pump on the left, as shown. The ram is 8 inches diameter. Space between the rails, 3 feet 2 inches, which will accommodate the largest driving wheel on the job, during the three winter months we took off and replaced 600 car wheels. The steel rails are 35 pounds to the yard, we have had a strain of 75 tons on this machine. I also inclose two views of tools in shop where press was built.

West Boylston. W. C. OVENDEN.

M. C. B. Committee on Draw Gear.

The committee appointed by the Master Car Builders' Association to report on draw gear has done a good deal of very important work. It has conducted a series of tests, in which eleven different styles of draw gear were handled. Under the M. C. B. drop hammer these gears were tested to destruction. The weight used was 1,640 lbs. and was dropped, beginning at one foot above the coupler, and this height was increased one foot at each succeeding blow.

A second series of tests, conducted at the Perdue University, was for the purpose of ascertaining the efficiency of the different styles of rigging, and also their relative standing under shocks and under steady pulls. These tests were made in the 300,000-lb. capacity tensile testing machine in the engineering laboratory of that institution. Manufacturers were permitted to view each his own product undergoing test, but not to witness the test of a rival gear.



HOME-MADE WHEEL PRESS IN WAUCHUSETT RESERVOIR.

Milholland Engines.

I note an error in the date assigned on page 237 of your June number to James Milholland's anthracite coal-burning passenger locomotive, "Hiawatha," which is stated to be "about 1874." As a matter of fact this engine was built in 1859, and its mate, the "Minnehaha," about the same time, I think.

Illustrations of a substantially similar engine, although of slightly smaller size, the "Vera Cruz," which was built by Mr. Milholland in 1857, will be found in the *London Engineer* of February 8, 1861, page 90. The "Vera Cruz" was the first engine having a long firebox extending over the rear driving axle, a construction which was introduced by Mr. Milholland, and has been extensively adopted both for anthracite and bituminous coal.

J. SNOWDEN BELL.

Pittsburgh, Pa.

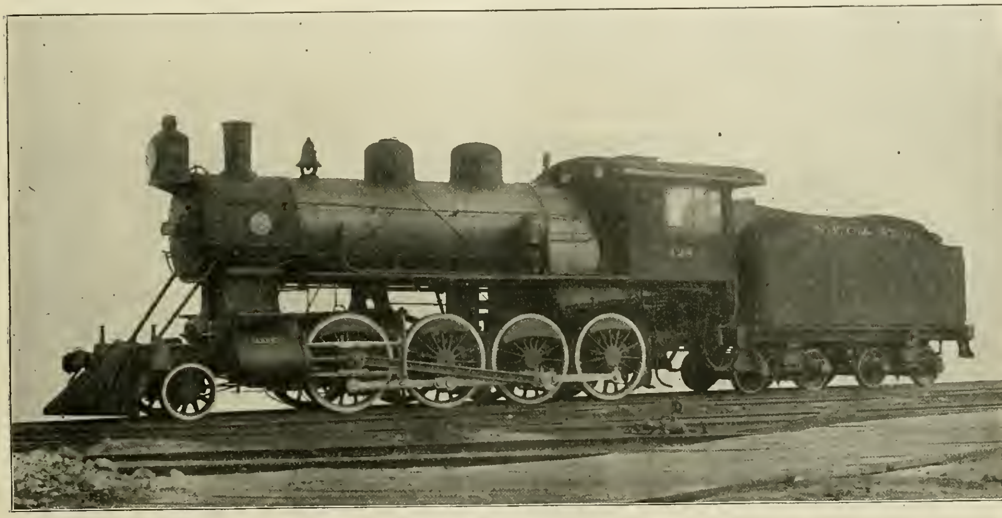
New P. R. R. Switch and Signal Station at Pittsburg.

One of the most complete switch and signal power plants is that recently installed at Pittsburg by the Pennsylvania system. In railway parlance this station is a "tower." It is, however, a handsome two-story brick building standing a short distance east of the new Union Station. Strictly speaking, it is not a tower, but a complete and modernly equipped power station for the operation of the hundreds of switches and signals of the Pennsylvania Railroad, the Allegheny Valley tracks, the Pittsburg, Fort Wayne & Chicago, and Pittsburg, Cincinnati, Chicago & St. Louis, which comprise the Pennsylvania lines west, all of which eminate from the new Pittsburg Union Station.

This mechanical operating station or tower, shows to those interested in railway matters the vast strides which have been made in railroad signaling during the past few years. It has not been so long since human muscles were applied to moving the switches. Then came the combining of switch levers in such a way that several of these could be operated by one man, and as tracks and switches multiplied, the intricate interlocking systems of operation came into use, and at last the problem of transmitting power from one station was solved. First small pipes served for this purpose. Later hydraulic power was introduced, and finally this system was supplanted by the pneumatic system which has been brought to such a high degree of perfection.

At the new operating plant of the Pennsylvania Company, in Pittsburg, the combined efficiency of electricity, compressed air and steam power is brought into play. From the station 231 switches and all the semaphore signals of fourteen tracks with their maze of cross-overs and double cross-overs, are operated. The operating mechanism is grouped in a large case, 20x5 feet. This nerve center is divided into three sections, each of which is under the care of one operator. The operator has before him a large, framed blue print, a diagram of all the tracks and switches. with which his section is in communication. By the movement of one of the numerous small cranks in front of the operator, an electric current is sent to the proper switch where the current vitalizes a magnet, and the hitherto inert bit of soft metal instantly opens a valve, which permits air at a pressure of 100 pounds to the sq. in. to enter a cylinder, pull a rod connected with levers, and thus move the points of an adjacent switch, in accordance with the requirements of the train dispatcher. Such is the condensed story of the electro-pneumatic switch and signal system now in operation at Pittsburg and in use at other great railway centers.

The power house which generates the electricity and compressed air is located a quarter of a mile down the tracks from the switch and signal station. In the lower part of the station are placed storage batteries. The experimental operation of this system in Pittsburg soon demonstrated the fact that the impure and smoke laden air of that city could not be used for the purpose, and it has been necessary to install a system of air filtering. In spite of the advances represented in this system, the Pennsylvania is now considering the matter of installing other improved apparatus for switch and signal operation. The company is also installing the duplex system of telegraphy whereby four operators can send or receive messages, using the same wire.



NICKEL PLATE CONSOLIDATION.

Simple Consolidation for the New York Chicago and St. Louis.

The Brooks shops of the American Locomotive Company have recently turned out ten simple consolidation engines for Mr. John McKenzie, Superintendent of Motive Power of the Nickel Plate Line. The engines are intended for fast freight service and have cylinders 19 x 28 inches and 62 inch drivers. Instead of the coil spring at the back of the equalizer system, there is a half elliptic spring, similar to those which rest upon the driving boxes. The ash-pan hopper doors are operated by linked connections, and in some general respects resemble the Player ash pan, which we illustrate in another column. The pedestal binders are new. Instead of the usual brace or bolt at that point the ends of the jaws are bound together by a clamp which is made to fit closely around them, and which has a screw and an adjusting nut. A filler is placed between the jaws and the clamp is then tightened up. A few of the principal dimensions are as follows:

DESCRIPTION.

Type	Consolidation.
Gauge	4 ft. 8½ in.
Kind of fuel to be used	Bituminous coal.
Weight on leading wheels	18,000 lbs.
Weight on driving wheels	140,000 "
Weight total	158,000 "
Weight tender loaded	202,000 "

GENERAL DIMENSIONS.

Wheel base, total of engine	25 ft. 0 in.
Wheel base, driving	16 " 9 "
Wheel base, total engine and tender	52 " 4½ "
Length over all, engine	38 " 8½ "
Length over all, total engine and tender	62 " 6 "
Length of stack above rail	14 " 11½ "

BOILER.

	Extended wagon top
Working pressure	200 lbs.
Thickness in tube sheet	⅝ in.
Diameter of barrel front	64⅛ "
" " " of throat	69⅜ "
Seams, horizontal	Quintuple lap
" circumferential	Double
Crown sheet stayed with	Radial stays

FIREBOX.

Type	Wide
Length	90 in.
Width	74 "
Depth, front	65¼ "
" back	52½ "
Brick arch	On water tubes
Water space at top	6 in. back, 5½ in. sides
Tubes, number of	306
" material	steel
" outside	2 in.
" thickness	No. 12 B. W. G.
" length over tube sheet.	14 ft. 9¾ in.

Heating surface, fire-box	136.5 sq. in.
Heating surface, tubes	2353 "
Heating surface, water tubes	23.8 "
Heating surface, total	2513.3 "
Grate area	45.2 "

WHEELS AND JOURNALS.

Driving wheels, diam	62 in.
Journal, leading axles	6 in. x 12 in.
" " " wheel fit	6 in.
" driving main	9 in. x 11 in.
" " others	8½ " x 11 "
" " main wheel fit.	8⅞ in.
" " others " "	8⅜ "

CYLINDERS.

Diameter	19 in.
Stroke	28 "
Piston Rod, diameter	3¾ "
Main Rod, length center to center	137 "
Steam Ports, length	24.2 "
" " width	2⅛ "
Exhaust " least area	65 sq. "
Bridge width	3⅛ "

VALVES.

	Improved piston
Steam lap (inside)	1 in.
Exhaust clearance (outside)	0 "
Lead in full gear	0 "

OTHER PARTS.

Exhaust Nozzle, dia	5 in.
Stack, straight or taper	Taper.
" least diameter, taper	14⅞ in.
" greatest diameter, taper	16 "
" height above smoke box	32 "

TENDER.

Type	8 wheel oak frame.
Tank type	Water bottom.
" capacity for water	5,000 gallons.
" " " coal	10 tons.
Type of trucks	Brooks all metal.
" " springs	Triple elliptic.
Diameter of wheels	33 in.
" length of journals	5 x 9 in.

The Burlington, Cedar Rapids & Northern Railway system has been absorbed by the Rock Island, under a lease of 999 years. The stockholders of the Cedar Rapids route in annual meeting decided to accept the proposition of the Rock Island, under which the stock in the former is exchanged for stock in the latter, share for share.

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Editorial Change.

In the beginning of June Mr. George S. Hodgins became a member of the editorial staff of Railway and Locomotive Engineering. We bespeak for him the favorable consideration of our numerous friends. Mr. Hodgins is not a stranger to the readers of this journal, as he was for years a correspondent whose writings were read with interest. He received a sound engineering education in the shop and in the drawing office and held several important positions on one of our leading railways. Mr. Hodgins was for some time editor of the *Railroad Digest*, so he is not new to the routine work of the office of a railway journal.

Valve Oil.

In one pint of valve oil fed through a lubricator in good repair at the rate of 5 drops feed per minute, there is not less than 6,600 drops. The valve oil on leaving the feed nozzle of the lubricator passes drop by drop through the water in the sight feed glasses and in that condition, drop by drop reaches the steam chest. The valve oil on passing into the oil pipe is not sprayed or atomized as is supposed by many, but travels entirely by gravity, and it will therefore appear plain that anything which may interfere with or delay its passage will cause the valves and cylinders to become dry. The oil pipes leading from the lubricator to the steam chests, or air pump, should have a gradual fall from the lubricator to these parts. When the oil is fed at the rate of 5 drops feed per minute, it will require 12 minutes for the oil to flow from the lubricator to the steam chest on a consolidation engine, and it is a good practice before putting an engine in service, to guard against possible defects or pockets in the oil pipes, by starting the lubricator to work at 5 drops feed per minute, disconnecting the oil pipes at the steam chests, noting the length of time it requires for the oil to flow from the lubricator to this point. If the time required is in excess of 15 minutes it is safe to conclude that there is a pocket in the oil pipe, which, of course, ought to be remedied, and as we know that it requires this time for the oil, under the very best of conditions, to flow from the lubricator to the steam chest, engineers should be instructed on this point, so that they may start the lubricator working a sufficient length of time before starting their trains as will allow of the oil reaching the steam chest about the time or a little before the engine starts on its trip. Knowing as we do that the oil will not flow up hill, it would seem that the best results in air pump lubrication might be obtained by attaching the lubricator pipe to the highest point on the steam end of the air pump. When attached to the pump at that point, 1 drop feed of oil per minute is all that is required to lubricate a 9½-inch or a 11-inch pump.

Five drops feed per minute will ordinarily be found sufficient for the largest engine and heaviest service; for smaller engines or light service a proportionately slower feed of oil will be found sufficient. Intelligent and economical results cannot be obtained unless enginemen know the rate at which the oil is being fed to the air pump and steam chests. Before commencing to ascend a heavy grade, it is a good idea to quicken the feed of oil a few minutes before reaching the foot of the grade, and as it has been conclusively proved that when a full throttle is being used on high pressure engines, especially at a low rate of speed, that the oil does not flow continuously to the steam chest. It is an excellent practice to occasionally close the throttle partially to allow such oil as has been held in suspension in the oil pipes to flow into the steam chest, the object of this being to momentarily reduce the pressure in the steam chest below that in the oil pipes. If a small quantity of oil is put in the lubricator, time should be allowed for the condensation to fill the cup and raise the oil to the top of the feed pipes or a sufficient quantity of water in addition to the oil applied should be added before the feed valves are opened. Immediately after the lubricator is filled the steam or water valve should be opened; the steam valve should always be opened first and opened full and should be shut last. If this practice is followed the water in the feed glasses will remain clear and there will be no loss of oil by syphoning. If the feed glasses become dirty they may be cleaned by rubbing a little glycerine on the inside of the glasses. If the lubricator is in good repair there will be very little variation in its feed between using steam and with the throttle closed; if the feed of the lubricator slackens when the throttle is opened or quickens when the throttle is closed, it may be concluded that the choke plugs have become enlarged and in that case satisfactory results cannot be obtained until the defects have been remedied. In most of the lubricators now on the market the choke plugs are located in the upper feed arms, and by disconnecting the oil pipe at that point can be conveniently reached and easily removed with a small monkey wrench, and as they are sold for about 50 cents a dozen, the expense attached to their renewal is very slight. At times it will be noticed that the drop of oil forming at the outlet of the feed nozzle takes a balloon-like shape and is slow in separating itself from the nozzle. This is due to a slight corrosion occurring at the tip and inside of the nozzle, and may be easily removed with a pin or any other small device. If the opening in the choke plug becomes stopped up, it can be opened by shutting the steam valve of the lubricator and opening the throttle valve of the engine, the pressure passing out through the oil pipe will force the substance in the lubricator down into the feed glass. If the feed valves become stopped up they can be opened by closing the condenser or water valve and opening the drain valve; the pressure will then force everything up into the lubricator.

In order to prevent small particles of waste or other matter getting into the oil cans in use on the locomotive, strainers should be used at all oil houses in the funnels used at those places.

The temperature of steam at 200 pounds pressure is 380 degrees; the fire test of valve oil is 550 degrees. The object of having the fire test of valve oil so high is to insure the retention of its lubricating qualities, even when subjected to a very high temperature. When valve oil is used extravagantly it is thrown out of the cylinders, lodged in the exhaust pipes, where it soon forms a very thick coating, reducing the size of the exhaust pipes and nozzles, increases the consumption of coal and interferes with the free working of the engine.

By the fire test of an oil is meant the temperature at which that oil will ignite. The fire test of valve oil is 550 degrees, the fire test of winter engine oil about 300 degrees, the fire test of summer engine oil about 400 degrees, the fire test of winter car oil is about 300 degrees, the fire test of summer car oil about 400 degrees, the fire test of winter coach oil about 300 degrees, the fire test of summer coach oil about 400 degrees, the fire test of signal

oil about 310 degrees. By the gravity of oil is meant its density as compared with water.

To lubricate is to facilitate the motion of bodies in contact by reducing friction. As an illustration of the difference between the gravity of oil and that of water, a pint of water will weigh 1 1-25 lbs., while a pint of oil will weigh considerably less than a pound. A lubricating oil should have sufficient gravity (density) to sustain the weight carried by the journal; the gravity of an oil is taken at 60 degrees of heat; an increase in the temperature of an oil causes a decrease in its gravity; for instance, if the gravity of an oil is given as 28, it means that that is its gravity at 60 degrees, and if the temperature is increased to 70 degrees, the gravity of the oil would then be 29. Therefore the gravity of an oil intended for fast passenger service is better than an oil intended for slower trains. On fast trains making long runs between stops the temperature of the journals and bearings is liable to become higher than on slower trains, and if an oil of poor gravity is used to start with, the result will be that as the temperature rises the film of oil between the bearings and journals becomes so thin as to allow these parts to come together. The consistency of an oil should be such as to allow it to flow freely to the parts requiring it; if a thick, sluggish oil is used it will not reach the parts requiring it until by heat it becomes sufficiently thinned, and as it requires friction to cause heat, the use of a thick oil on locomotive or car journals means a hard-pulling train, less tonnage moved and an increase in fuel consumption. The feeders in oil cups and the packing in locomotive and car journal boxes should be such as to assure the oil intended for those parts being there before the engine or train is started on its trip. The packing should be thoroughly saturated with oil and in close contact with the journals, for no matter how much oil may be in the oil box or cellar, if it does not reach the journal it does no good, hence the necessity for close and frequent inspection of the packing in car and tender truck oil boxes, also in driving box and engine truck cellars; a frequent loosening up of the packing in those parts is absolutely essential to efficient lubrication. It must, however, be borne in mind that no matter how high the quality of oil, it will not give good results if the mechanical conditions are not good, or when indifferent attention is given to the application of the oil.

If car or locomotive journals are tapered, or the brass removed from a journal worn to 4⅛ inches is applied to a journal 4¼ inches in diameter, a hot journal will be likely to follow. Before wheels are applied, dirt, rust, paint or other substances should be removed; to do this a roughly sawed piece of hardwood will be found an efficient tool, as it will cut off the dirt and rust and will not scratch the journal.

The Practical Mechanic vs. The Mechanical Engineer.

In a comparison of the relative value of the above important factors in the administration of motive power affairs, we took occasion in our May issue to put the practical man to the fore, giving him a precedence denied so zealously by a certain class, who are seemingly actuated by self-interest rather than a desire to be just in the premises. The policy of pushing the college-trained man into places of preferment, and that too often without the necessary requirements to make his record other than a commonplace one, has been fostered for a few years past by the technical graduate, to the detriment and undoing of a class of men who deserve better things at the hands of employers of practical talent.

A correspondent takes occasion in our June issue to make good the claim so ardently pressed, that the college-trained man is best fitted to cope with the trials of the railroad machinery department and produce net results not possible to the less fortunate practical man. In that article, the author takes occasion to say that, in his belief, our article was written to bring out discussion of the matter; this, we desire to say, was to some extent our object, although these columns are always open to the discussion of anything of interest to the railroad man. Our object, however, was to bring attention to a state of things that appear to us to need a little light, and in our touching on the question of design we simply stated what is notorious to all designers, namely: that the best past practice is used as a basis for new work. This is well understood and goes without refutation, but original designs of either locomotives or cars involve no principles in engineering not possessed by our superintendents of motive power of the practical school, for there are few of them who have reached their position through the ranks, to whom bending and resisting moments are strange terms.

Some great stress is laid by our correspondent on the need of executive ability in the successful head of the machinery department. What is executive ability but the knowledge of how to handle a body of men so as to give paying results? This ability, it seems to us, is the natural result of the mastery of the details of one's profession, and it is obvious that such knowledge can only be acquired by long years of experience, and it is not received with the much-prized parchment on the day of matriculation. Executive ability is another name for getting the other fellow to do the work, while the head receives the credit for duties actually performed by those fitted by experience to transact the business—no matter whether the head has the advantage of a college course, or just simply a common school training. Our contention is well proven by the successful careers of men at the head of our motive power departments, men who have dug their laurels out of the solid, with no capital except a common school education and a trade.

The average college graduate has not shown a disposition to get down into the details of the practical side of his profession, and that fact is the one important element that is lacking to produce success in his career. We can recall but a few instances where he has accepted the advice of those interested in his welfare, the advice of practical men, and worn the overalls long enough to be of any lasting benefit. This is where the graduated mechanical engineer falls down. In this connection, because it has a direct bearing on the above, and also because the sentiments, while old, are uttered by a man who is at the head of one of the most powerful corporations, but who never saw the inside of anything but the commonest of common schools, we will quote the words of President Charles M. Schwab, of the Steel Trust, who, after donating $60,000 to the State College of Pennslylvania a few days ago, spoke in part as follows to the students: "The college man must start at the bottom. One reason why practical men are at the head of organizations is because the college man depends too much on his diploma. The college man who will not start at the bottom will be outstripped by those he finds fault with." This advice coming from a man who has reached his present position through a study of the details of his business by long service in the ranks ought to be of value to those young men.

An earnest following of such a course as proposed above would do more to break down the aristocratic tendencies absorbed at school and retained in after life than any other one thing, simply because the student would see and understand from the practical man's standpoint. This could not be other than beneficial to the service, for nothing can be more subversive of discipline or *esprit de corps* than to have cliques on any department of a railroad. That this is true it is only necessary to point to a department dominated by either mechanical or civil engineers, or any other cabal, for proof.

There is no bias intended in these lines, we being content to simply voice the sentiments of some successful railroad men. We have no war with the college-bred man, nothing but the highest regard for his welfare, as our course with reference to the Stevens Institute scholarships will attest, and also our proposition that a recent bequest to the Master Mechanics' Association be applied to the same purpose, but we do object to the relegation of the practical man to retirement to make room for the man who is no better equipped than he to handle the problems of motive power management, and all because of a fad well nurtured.

Starved Genteel Occupations.

There once was a time in the history of the industrial world when the son nearly always succeeded in following the trade, art or calling of his father. In all cities there were certain guilds that dominated trades, arts and regular occupations of all kinds and exercised an influence not unlike what is now exercised by well managed trades unions. These guilds permitted no one to enter into apprenticeship in any business who was not entitled to the great privilege by being the son of a member of the guild or for some other special reason. We believe that the habit engendered of the son following the father's occupation developed hereditary skill, and that the splendidly artistic artisan work, found among the product of our earlier industrial period, were the product of this highly developed skill, just as we see breeding traits in animals.

This tendency for the son to follow the father's occupation is still very common in Europe, even railway men, who follow almost the newest line of work, are encouraged to introduce their sons into the same employment and willingly do so. Strangely enough there is very little tendency in the United States for the son to follow the father's occupation, especially in mechanical pursuits and in railway train service. We believe that the wives of train men are to a great extent responsible for turning their sons into other lines of business. The mothers of the last few generations have been becoming so genteel and snobbish that they cannot endure the idea of their sons having to wear overalls and put their hands to greasy work. They must have their sons following a genteel occupation, where they can wear a starched shirt all the time and never need to soil their hands with hard work. Very often the woman who has herself been a servant or something else calling for hard, honest work before marriage, displays the greatest anxiety to have her sons enlisted among the class that wear collars and cuffs while at work. These mothers very often inflict a life of penury and drudgery upon their offspring by pushing them into the overcrowded genteel occupations. A clerk is the worst paid and the most dependent worker in our midst, and he has to endure the hardship that comes from hundreds always being ready to take his job for even less money. While first class workmen are never idle in the hardest of times, a first class clerk who loses his position has the very greatest difficulty in finding another one.

A very interesting statement concerning the condition of the office clerk as compared with that of the artisan is given in a recent number of the *Saturday Evening Post*, by Mr. Henry Chapman Watson, editor of *Dun's Review*. Duns agency is devoted to showing the financial condition of companies and people doing business in all lines of trade. Among the facts given by Mr. Watson of special interest to wage earners are:

"The wage earner has been so well employed that he has swelled the deposits in savings banks beyond all records, and is able to carry a larger life insurance, besides putting money in building and loan associations. These forms of investment appeal to the man in moderate circumstances, and his success or failure is quickly reflected in the reports of these companies."

* * * * *

"Though artisans, skilled labor in every branch of manufacturing, and the agricultural communities have prospered remarkably in the past few years, the enhanced cost of living has been met with most difficulty by the office employees in the big cities. With them the supply is always greater than the demand, even when there is an urgent need for skilled labor in the trades. To some extent this is due to the national passion for excitement; the desire to be where there is the greatest activity and the most varied forms of amusement.

"But another and powerful influence is the ambition of parents to have their sons engaged in what they deem a 'gentleman's' occupation. The father is a skilled mechanic, earning $4 or $5 a day, and always able to find employment. The son has the advantage of a good free school education, and when he graduates he is sent to the nearest city to work in an office. His parents want him to have social advantages which they fear can not be had if he follows his father's life of manual labor. The result is an army of clerks, who can never earn above $18 or $20 a week, and who are confined in more or less poorly ventilated offices, instead of following the healthier and more productive lives led by their parents, which are deserted in the effort to gain social possibilities. It is no exaggeration to say that a capable carpenter, plumber, or skilled machinist seldom seeks long for work, and earns $24 a week readily, whereas office assistants are abundant at $15. Industrial activity stimulates the demand for skilled labor and puts a premium on good mechanics, but a large mercantile house can extend its office force of clerks with little expense. Hence, the enhanced cost of living is felt by this one class more severely than by any other because they seldom share proportionately in the benefits of greater general prosperity."

All students of the International Correspondence Schools of the Locomotive Running, Air Brake or Trainmen's Courses who are entitled to bound volumes and have not yet received them, may do so by sending their correct address and class letter and number to W. N. Mitchell, Manager Railway Department, Bush Temple of Music, North Clark street, Chicago, Ill.

Proposed Changes in the M. C. B. Code of Car Interchange Rules.

The Western Car Foremen's Association suggested changing section 2 of rule 3 to read: "Shelled out: wheels with defective treads on account of pieces shelling out; if the spots are over 2½ inches on wheels under cars of 60,000 lbs. capacity or under, and if over 2 inches on wheels under cars over 60,000 lbs. capacity, or are so numerous as to endanger the safety of the wheel."

The arbitration committee of the M. C. B. Association which has this matter in hand did not recommend this change, and it consequently had small chance of being adopted.

The suggestion is, however, worthy of this much consideration. A car foreman's association has seen fit to link size of shelled out spots on a wheel and car capacity together. Whether or not the suggestion just in that form was advisable, we do not pretend to say. We wish to point to the significent fact that a body of practical men who have to deal with car interchange problems at close range, recognize capacity of cars, as of importance in determining the relative danger or safety of certain defects.

Some years ago the M. C. B. Association made it one of the rules in the code that all cars should be stenciled with capacity, because size of azle and capacity of car were closely inter-related.

Intelligent inspection, for safety pure and simple, cannot be had if any car is let run without its proper capacity being plainly stenciled upon it. To run a car without marked capacity is is much against the M. C. B. rules as if it had no brakes, yet there are private line cars running to-day on which no capacity is stenciled, and it is utterly impossible for a car inspector to tell whether the axles he sees under such a car are within the limits of safety or are a direct menace to life and property. A car without stated capacity has absolutely no legitimate place upon a steam railroad to-day. The fact that the cars upon which capacity figures are not painted, are the property of lines which do not own a mile of operated railroad track, speaks volumes.

When one considers that certain sized axles are permitted by the M. C. B. rules under cars of definite capacity, and that the M. C. B. Association took expert opinion upon the relation of the one to the other before enacting the rule, it is apparent that capacity stenciled upon the sides of a car is as much a safety appliance as a grab iron or vertical plain coupler, and that to disregard the rule which states that capacity must be given, is a reckless attempt to defy efforts to secure safety in railway operation, by those who are not compelled to face the grave responsibilities of the situation. The Interstate Commerce Commission has as direct an interest in any violations of the "capacity rule," as it has in the failure to apply effi-

cient brakes, automatic couplers or safety hand holds for railway employees.

Railway companies should be empowered to examine all cars, stencil correct weight and capacity, and charge owners, neglecting capacity statement, with an amount representing the full cost of doing the work, plus 10 per cent. as a fine for non-compliance with the M. C. B. rules.

Piece Work in Railway Shops.

"In regard to supervision, piece work does not take nearly as much time or give as much trouble as day work does;" so said Mr. C. A. Hubbs, the general car foreman, O. R. & N. Ry., at a recent meeting of the Pacific Coast Club. He explained that the reason for this was that after the contract was given out the work remains in the hands of the machinist until completed, and the foreman knows how long it will take to do it. The point was also brought out that, under the day work system, a rapid worker is apt to become discouraged after a time, and will probably drop back to the slower pace of those about him. The strong point about piece work when honestly carried out is that one price is not paid to-day and another to-morrow.

Mr. W. C. Fitch, looking at the question "which in the long run pays our railway companies the best, piece work or day work, supposing both receive the same supervision," said that in the light of his experience in the car paint shop he believed piece work was a benefit to the company. There is less worry for a foreman where piece work is the rule, because supervision consists mainly in seeing that the work is properly done, whereas when accomplished by day labor, it consists not only in seeing that work is properly done, but also in seeing that it is done in a certain time.

On the other side of the question Mr. R. B. Prideaux pointed out that piece work had a tendency to take a workman's pride out of his work, and that if his work is not examined closely, there is a chance for a man to slight his work. Interior car painting, the speaker said, does not show up until it has been in service for some time, and if badly done the company is at a loss. Mr. Prideaux, however, thought that piece work was the more economical system in a great many cases.' Such work as cleaning a car, coating, varnishing, striping, rubbing rough stuff, and all work which can be executed without interruption were good piece work subjects.

Several other speakers also gave their experience of piece work, and were favorable to it, where the system is fairly administered. In the discussion which followed, Mr. Wren, foreman blacksmith of the Southern Pacific, pointed out that good judgment by the foreman in charge was a very important factor in the case. Often a man in a railway shop working on piece work and having all his tools and appliances ready is suddenly compelled to abandon what he is at and turn in and help repair an engine which has come in, broken down. After the emergency is over, he certainly loses time getting his appliances in place again to go on with piece work. Good judgment and fair dealing are the keys of the situation on both sides in such a case.

Standard Pipe Unions.

The report of the Committee on standard pipe unions, made to the M. C. B. Association at the June convention at Saratoga, contained a brief history of the events leading up to the report.

Originally there was a committee appointed by the M. C. B. Association, the American Railway Master Mechanics' Association and the American Society of Mechanical Engineers, to consider the subjects of (1) Square Bolt Heads and Nuts, (2) Standard Pipe Threads, and (3) Standard Pipe Unions. In order to facilitate the work and have each subject given proper attention, the subjects were divided between the three associations, the Master Car Builders' Association taking charge of the first subject, namely, Square Bolt Heads and Nuts; the American Railway Master Mechanics' Association the second subject, namely, Standard Pipe Threads, and the American Society of Mechanical Engineers the third subject, namely, Standard Pipe Unions.

The first two subjects have already been disposed of, and the report of the committee of the American Society of Mechanical Engineers on this subject was submitted to the M. C. B. Association. Among other things, it was suggested to use the letter "S," enclosed in a circle on each nut of the Standard pipe union, in order to distinguish it from all others. It is safe to say that a standard of this kind, adopted by three such influential associations as those mentioned above, will in time become standard practice all over the country.

The Board of Trade of Great Britain have general supervision of railways in the British Isles and the regulations which they require to be followed are sometimes very embarrassing to the people who travel. One rule they have promulgated is that the speed of tramway cars shall be limited to eight miles an hour. This is very inconvenient in country districts where cars could be safely run at double the speed allowed by the Board of Trade. Those who are put to inconvenience by the slow speed allege that the rule is enforced in the interest of surface railways which take this means of damaging competitors. We doubt the correctness of this, for the Board of Trade have to bow to public opinion, and the rural authorities have influence enough to restrict the speed of any vehicle moved by anything without a tail.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters in the waste basket.

(144) J. C. C., Bowling Green, Ky., asks:

Why will a head lamp blow out running with part of the glass broken out, when if you break all of the glass out it will burn all right? A.—If a hand lamp be used out on top of a train, or even in a yard, with the glass globe broken, it will surely be blown out. Standing in a room or other secluded place, however, where there are peculiar drafts, it might be possible for a flame to exist longer on a lamp with no globe at all than on one with a piece so broken out as to assist the draft. But we cannot agree that a lamp would act as the case is stated.

(145) W. H. K., Hagerstown, Md., writes:

1. Please explain fully what is meant by the "viscosity" as well as "specific gravity" of oil? A.—Viscosity in oil means the thickness, stickiness, the gumminess. Water and kerosine are less viscous than valve oil. The specific gravity of an oil is the weight of any volume of it compared with that of an equal volume of water. 2. What are the vital or essential features to be considered in lubricating oil? A.—It must successfully combat friction, eliminate it, and leave little or no residue behind it. 3. What amount of oil is necessary to properly lubricate a 75-ton consolidation engine under ordinary conditions in cylinder and engine oil? A.—It depends entirely on the existing local conditions, such as condition of the parts and work performed by the engine. No hard and fast rule can be laid down. 4. What effect does the different kinds of cylinder oil have in stopping up the exhaust nozzle or tip, also the effect on the metal in the steam chests and cylinders? A.—An excessive and superfluous amount of any kind of cylinder oil will more or less choke up the nozzle. Almost any kind of high grade cylinder oil has a least possible bad effect on the metal in steam chest and cylinders. Tallow has a deteriorating influence on cast iron parts. 5. Will oil be carried uniformly in a steam pipe with steam, or will it go along the sides? If so, where and why? A.—It is popularly supposed to vaporize when brought in contact with the heat of the steam, and be carried in suspension with the steam, and doubtless does to a greater extent, still much adheres to the sides and is carried along the bottom of the pipe. 6. If oil and water will not mix, will steam and oil mix? If so why? A.—Answered in above question. 7. How many square inches of cast iron should one cubic inch of good cylinder oil lubri-

cate properly, under 160 pounds of steam pressure? A.—Impossible to answer without making a specific test under known conditions. Depends entirely on conditions, and will vary with character of work, etc. 8. Are there any works published on this particular subject? If so where can they be obtained? A.—We do not know of any. The oil men could probably help you to the information.

(146) W. E. R., Philadelphia, Pa., asks: Does the working of a full or light throttle have anything to do with the working of a lubricator? A.—Yes. With a wide open throttle and reverse lever cut well back, the steam reaches the steam chest faster than the slide valve can pass it to the cylinder. Consequently the pressure and temperature both in the steam chest are nearly equal to that in the boiler. The result is that the current necessary to carry the oil along is lacking, and the oil will hang back until the throttle is closed or eased off, then it floods to the valve and cylinder.

Good Service from Car Lubricator.

Mr. E. B. Gilbert, master mechanic of the Bessemer & Lake Erie, writes very flatteringly about his experience with a lubricator supplied by the American Lubricator Co. He says:

"We have had your lubricator in service since February 12 applied to our coach No. 28, running between Grove City and Erie, a distance of 182 miles, daily, except Sundays. This car has made over 12,000 miles. Each machine when placed in journal box was suppplied with three pints of oil. No additional oil has been used and enough oil remains in the boxes to run the car for some time yet.

"This car had all new bearings at the time the machines were applied, and the thermometer was 14 degrees below zero at the time this car was started out and zero weather continued for a week.

"I am of the opinion that a passenger car with two four-wheeled trucks will run 10,000 miles with an oil consumption not exceeding one gallon per car.

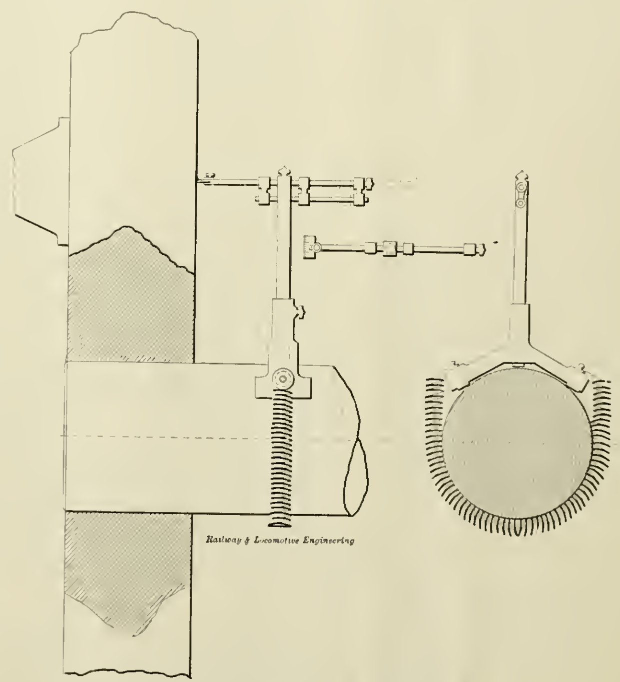
"Will also state that the entire train that this coach is running in has been equipped, including the tender of the engine, and has run over 6,000 miles and is running entirely satisfactory."

Railway Employees in the United States.

Statistics about the number of railway people employed in the United States are compiled very slowly; but the figures may be relied upon as being fairly correct. We have recently received a table of statistics which says that in the year 1900 there were no less than 1,017,653 railway employees in the United States, no other business owning so many except agriculture, and that upon the earnings of these men 5,000,000 persons were dependent. Engineers, firemen and conductors alone constitute an industrial army of 116,000 men. Including other trainmen, station agents, switchmen, telegraph operators and dispatchers, one-third of the million employees are engaged directly in the operating of trains. Over a quarter of a million men are needed to keep tracks in repair, while another quarter of a million are required in shops and elsewhere to maintain the plant. This vast army is controlled by 10,000 offices, containing 30,000 clerks. The accident rate—annual loss by death—is 1 in 339, and the annual injuries amo nt to 1 in 39.

Gauge for Twisting Wheel Centers.

The accompanying sketch illustrates a very handy gauge for throwing locomotive driving wheels into quarter, either new ones or where new axle has been put in and where it is desired to not remove the crank pins or to save the stock in hole where crank pins have been removed.



GAUGE FOR TWISTING WHEEL CENTERS.

As illustrated the stand of this gauge is held firmly on the axle by means of a coil spring. By striking a line on spoke or hub of wheel center and bringing up the graduated face of gauge at the radius of center of crank pin the gauge recedes as the wheel is pressed on showing by a 64-inch graduation, the amount the wheel is being thrown. If it has been ascertained how much a pair of wheels are out by means of this gauge they can be thrown into exact quarter without putting them through the quartering machine again or otherwise measuring them up; thus saving a great deal of time and labor handling heavy drivers a second or third time. This gauge was gotten up by J. D. Young, machine foreman of the Burlington & Missouri River Railroad shops at Havelock, Nebraska, where it has been put to the practical test and has been satisfactorily used for some time.

High Speed Brakes for the Pennsylvania.

The Pennsylvania Railroad has been making extensive trials with the Westinghouse high-speed brake, and has determined to equip all its passenger rolling stock with this safety appliance. Lines east and west of Pittsburg will use the brake, and the cost of putting it on the cars is estimated at about $130,000. The high-speed brake is about 25 per cent. more efficient than the ordinary air brake, and depends for its efficiency upon the fact that a rapidly rotating wheel may receive, and be simply retarded by, brake shoe pressure, which would slide the wheels if rotating more slowly. As the speed of the train is reduced the brake shoe pressure also is lowered, so that maximum retardation, without wheel sliding is the constant effect of the high-speed brake.

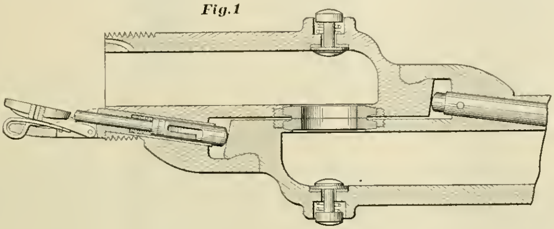
Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Disadvantages of a Temporarily Appointed Air Brake Inspector.

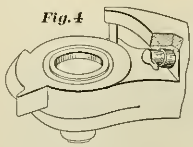
There is a firm belief, born of extensive experience, that every railroad should have a regularly appointed air brake inspector. The mere appointment of some man from the ranks to temporarily fill the position will not bring good results. This method of temporizing has been tried and found to be sadly defective. The only proper way to procure the best and lasting results is to appoint a man of ability and give him the support of the superintendent of motive power or some other high official. In this way the man regularly appointed carries weight, and his suggestions and advice will be taken and acted upon by foremen and other officials in lower capacities. In this event, when the general inspector informs a round-house foreman that the brake valve on a certain engine, or the pump, or the triple valve, or the brake cylinder packing or some other part of the air brake apparatus on that locomotive should have inspection and repairs, the suggestion is at once acted upon, as the foreman feels that the suggestion coming from the regularly appointed air brake inspector is virtually an order supported by the superintendent of motive power or other persons backing the air brake inspector, and not merely as a suggestion coming from a locomotive engineer, from whose ranks the temporary inspector has probably been appointed.

Fig.1



An illustration was recently afforded by a temporarily appointed air brake inspector on one of our large railroads who went to the foreman of a round-house and informed the foreman that the brake valve on a certain engine upon which he had just been riding needed the rotary valve reseated and the equalizing piston cleaned. The foreman, not considering the suggestion from the temporarily appointed inspector as being a very weighty one, and if acted upon would require the services of a man who he had working on some other job, mildly informed the temporarily appointed inspector that work was a little brisk just now, and to wait until the engineer of the locomotive in question should regularly report the disorder mentioned, when the work would be done. This was rather a harsh rebuff to the temporarily appointed inspector, who was endeavoring to make a good record for himself, hoping thereby to later on secure the permanent appointment; but he was obliged to submit to the foreman's decision. Should such efforts be rebuffed at all points of the road, a temporarily appointed inspector had far better remain on his engine, or any other place from whence he came, rather than to attempt to make a record as an insoector that would entitle him to consideration in the eyes of his employers. The only way to secure the desired good results is to make a careful selection of a good man, clothe him with proper responsibility and backing, and demand good results of him. Temporizing does vastly more harm than good.

Fig.4



Railway & Locomotive Engineering

Correspondents will confer a favor by sending their communications to us as early as possible in the month.

A Patented Hose Coupling.

The accompanying illustrations show a hose coupling device invented by A. S. Cummins and A. J. Bland, of Crewe, Va. It closes inside the hose when uncoupled, and keeps dirt out of the hose when uncoupled.

Fig. 1 shows the hose coupled with the valve open. Fig. 2 shows the valve closed. Fig. 3 is a plan view of the coupling connected and valve open. Fig. 4 illustrates the coupling head with the operating stem to the valve.

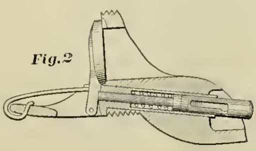
Misunderstanding of the Quick Action Triple Valve.

We have a letter from a correspondent suggesting the abandonment of the quick action feature of the triple valve, wherein he says that the quick action feature is so largely responsible for break-in-twos of trains. To those persons who have not been in air brake practice for more than a few years this subject will prove interesting and doubtless instructive and is well worth considering.

We do not believe that the break-in-twos which our correspondent mentions are very largely due to the brakes, but rather to the uncoupling of worn knuckles of the couplers. Investigation in the recent past has proven that many of the break-in-twos and resultant smash-ups are due to this cause, rather than to the unexpected emergency application of the brake, hose pulling apart and hose bursting. It would seem, therefore, from these recent investigations that the air brake is oftener credited with damages such as smash-ups, etc., than it should be.

It is interesting to note the growth and history of the quick action triple valve. In the Master Car Builders' brake tests in 1887, the 50-car train presented by the Westinghouse Company for trial in the competition with other brakes, was equipped with plain triple valves, such as our correspondent would now recommend in place of the quick action form. The result was that the plain triples, while working entirely satisfactorily on a short train, were wholly inadequate to meet the demands of long

Fig.2



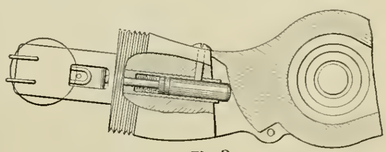


Fig.3

train service. When the emergency application was made on the 50-car train, the slack ran in with so much force as to produce a tremendous shock to the rear cars and the caboose. This shock caused all of the loose articles of furniture in the caboose to be transferred to the forward end and the freight in the rear cars were either transferred to the forward end of the car or knocked clean through it. So disastrous were these shocks on the long 50-car train equipped with plain triple valves that the train was obliged to withdraw from the contest.

The following year the Westinghouse Company again appeared in the competitive trials with a 50-car train equipped with quick action triple valves. At first the shocks to the rear cars and caboose were nearly as bad as those produced on the train equipped with the plain triple valves. After some modification of the quick action triple valves the shocks to the rear cars were done away with entirely, and the furniture in the caboose and the lading in the rear cars remained stationary and were unmoved.

It should be observed that the quick action triple valve applies the brake on each car simultaneous with the running in of the slack and thus prevents the shock above described and referred to. In fact, the quick action triple valve really accomplishes that which our correspondent believes it does not do, and that which he would not get if he were to so modify the present standard triple valve as to annul the quick acting feature. He should brush up a bit on air brake history and air brake practices.

Quite a spirited discussion was had on the High Speed Brake at the May meeting of the Central Railway Club.

CORRESPONDENCE.

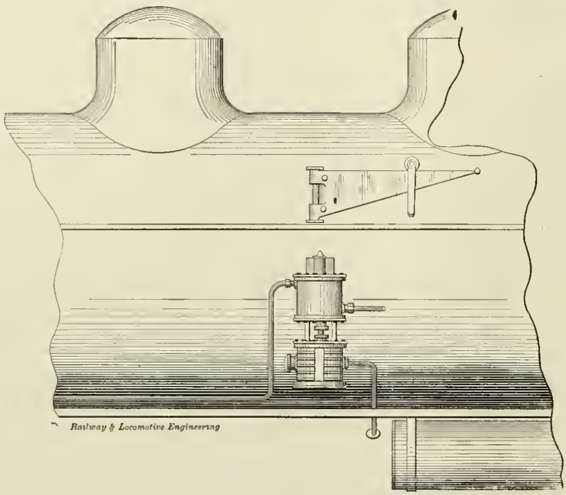
Crane for Air Pump.

Interested in the novel detail of a crane being sent out with new engine, as shown on Page 27, Santa Fé Decapod, prompts me to ask why did not these people also send one over the air pump, for I consider that is the proper place for a crane if anywhere. I have seen the time that a crane in the position illustrated in accompanying sketch would have soon paid for itself.

Manchester, N. H. FRANK RATTEK.

To Abolish the Quick Action Feature.

Referring to Mr. A. J. O'Hara's suggestion in June number of RAILWAY AND LOCOMOTIVE ENGINEERING, to abolish quick-action features of triple valve.

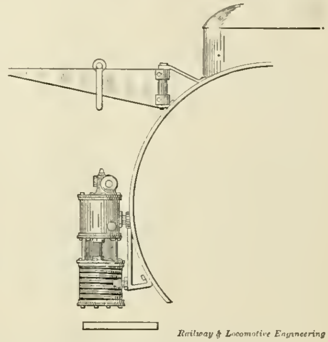


PROPOSED CRANE FOR AIR PUMP.—CRANE WHEN NOT BEING USED.

At the Burlington brake tests of 1887 there were 50 cars equipped with Westinghouse plain triples, and the shocks at the rear end of the train were so severe that it was found impracticable to use loaded cars in making these tests, as the loads would go through the ends of the cars.

If, with a train of 50 cars, all equipped with plain triples, the head brakes apply so much sooner than the brakes on the rear of the train, that it allows the slack to run in and produce such disastrous shocks at the rear end, I think it would produce still worse shocks if the train was only partially equipped with air brakes.

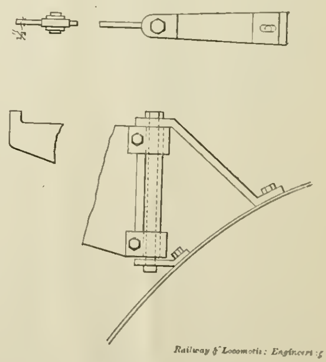
The removal of the quick-action parts would practically convert the quick-action triple into a plain triple, and it has been practically demonstrated that this style of valve would not give satisfactory service on long trains. The quick-action triple was invented to take the place of the plain triple, and as its action is so much quicker (each triple in turn reducing train line pressure in emergency application), the brakes are applied at rear end of train before the slack has a chance run in and produce shocks sufficient to shift loads or start ends of cars.



CRANE IN OPERATING POSITION.

I do not think it would be practicable to abolish the quick-action valves in triple. The statement made by Mr. O'Hara that "we would never miss it, as we never use it," is not exactly right. if it read "They are used a great many times when it is not necessary" I think it would be nearer the truth.

E. S. BOTTOMLY.
Foreman Car Inspectors N. Y., N. H. & H. R. R.
New Haven, Conn.



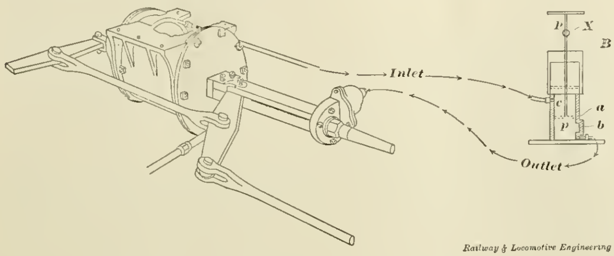
DETAILS OF CRANE.

The proceedings of the Pittsburg convention of the Air Brake Association should be out about August 15, and will doubtless be interesting and instructive as usual.

At no time in the history of the air brake art has frozen train pipes received so much attention as at the present time.

Slack Adjuster Device.

I submit to you a sketch of a device which I consider is an improvement on the McKee slack adjuster. The cut shows the usual arrangement of the slack adjuster itself and my improved attachment *B*: *B* is to be fastened securely between the truck bolster and the spring plank, with a universal joint at *X*, to allow for the swaying of the truck.



PROPOSED MODIFICATION OF THE SLACK ADJUSTER.

When the car is unloaded the piston *p* will ascend in the position shown in the cut in this addition, the air coming from the brake cylinder to the attachments goes into chamber *E* and there remains, not being permitted to pass to the cylinder of the adjuster to turn the screw and take up the slack.

When the car is loaded, the piston *p* will be pushed down to the position *b*, where the air from chamber *E* passes to the outlet of the device *B* and goes to the adjuster cylinder, where it will take up slack.

The improvement lies in the fact that when the car is light or unloaded the device *B* will not permit the adjuster to operate, but when the car is loaded, the device *B* permits the air to pass as usual to the adjuster cylinder, thus taking up slack on a loaded car, but not on a light car.

A. J. O'Hara,
Engineer Erie R. R.

Port Jervis, N. Y.

Slid-Flat Wheels.

I have seen wheels under a freight car slide in cold weather when the brake shoes did not touch the wheels at all. It would seem from this that the cause of the wheel sliding is entirely due to the presence of some influence, either in the journal box between the axle and the journal bearing, or between the circumference of the wheel and the rail. It is therefore reasonable to suppose that, if the brake is reasonably clear of snow and ice, and the rail is fairly good, that the trouble must lie in the journal box. Possibly this trouble is due to either the poor quality of lubricating oil used or to the absence of any oil at all, or the frozen condition of the oil between the journal and its bearing. M. F. Burns.

Utica, N. Y.

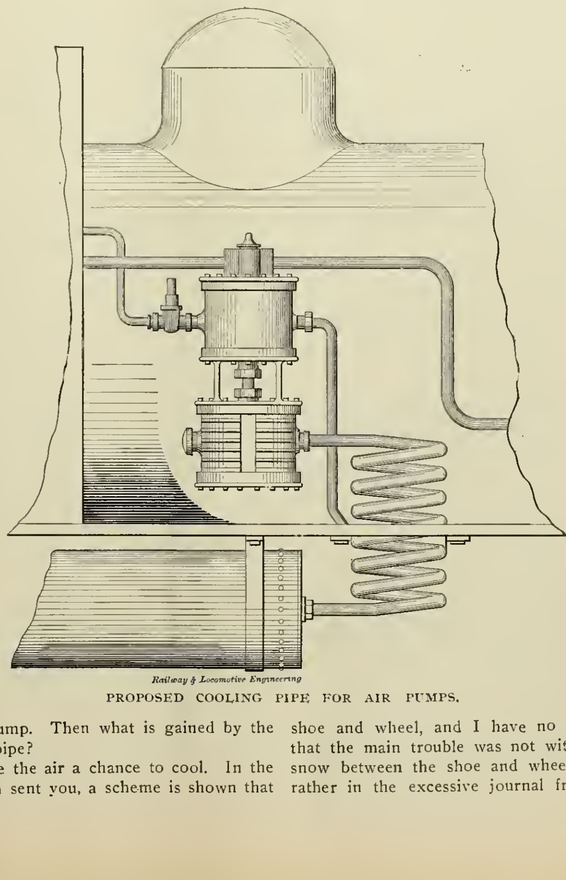
Cooling Pipe for Air Pumps.

The problem of frozen train pipes was at the late convention pretty well hammered on, and was quite interesting then. In your paper, Page 255, you advocate more strongly and urge a longer delivery pipe to the pump, giving the air a chance to cool.

Now, I have found out that it is not always the long pipe that allows the air to cool. A 5-foot pipe exposed to the wind will cool the air better than 20 feet of pipe that is wrapped around the firebox; for this long pipe may be at all times hotter than the air delivered from the pump. Then what is gained by the long pipe?

Give the air a chance to cool. In the sketch sent you, a scheme is shown that is believed to be a better plan than the long, straight pipe. Twenty or 30 feet of pipe in a spiral as shown and in an exposed position will be quite effectual.

Manchester, N. H. Frank Rattek.



PROPOSED COOLING PIPE FOR AIR PUMPS.

Slid-Flat Wheels Due to Journal Friction.

Touching on the question of axle friction as a factor in the slid-flat wheel problem, I would say that while much attention has been given to slid-flat wheels in the past, that no particular reference has been made to slid-flat wheels caused by the excessive friction between the axle and the brass bearing. It seems entirely reasonable that this friction should have a very great ininfluence on slid-flat wheels, in cold climates especially. It is reasonable to suppose that in very cold weather the journal will not turn as freely in the brass as it will in warm weather.

It will be interesting to observe during the coming winter just what effect this journal friction has on slid-flat wheels, for I have ofttimes noticed that wheels will slide after water had been poured in a box to cool off a hot journal. I have also seen wheels slide that were clogged with snow between the brake shoe and wheel, and I have no doubt that the main trouble was not with the snow between the shoe and wheel, but rather in the excessive journal friction

in the box due to cold weather, frozen oil, or something of this sort. Let us prepare to watch this thing next winter.

A. B. CRUTCHFIELD.

St. Paul, Minn.

Larger Brake Cylinders.

Referring to the air brake equipment on the new freight cars of 80,000 and 100,000 pounds capacity, a great many of these cars weigh from 40,000 to 45,000 pounds and are equipped with eight-inch brake cylinders. In order to get the proper braking power it is necessary to use a total leverage of ten or eleven.

If the slack is adjusted for a 6-inch piston travel when the car is standing, it will probably have from 7 to 7½ inches travel when the car is running; and with this high leverage it will only require one-half inch worn off the brake shoes before the piston will strike non-pressure head, and the brake on that car will be worthless.

If it was considered necessary to place 10 and 12 inch brake cylinders on passenger cars, I do not see why it is not necessary to use larger brake cylinders on freight equipment, thereby keeping the total leverage as low as possible and not requiring so frequent adjustment of brakes to keep piston within proper limits.

With the new cars of 80,000 and 100,000 pounds capacity which are braked from 65 to 78 per cent. of the light weight of the car, a difference of four or five inches in piston travel makes a great deal of difference in braking power; and when we consider that with a total leverage of ten, one-half inch worn off the brake shoes increases the piston travel five inches, it seems necessary that a larger brake cylinder should be used to do the work. I would like to hear what some of the air brake men have to say in regard to this subject.

E. S. BOTTOMLY,
Foreman Car Inspectors.

Manchester, N. H.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(155) E. C. P., Brooklyn, N. Y., asks:

Can the excess pressure valve of the New York brake valve be cleaned without drawing off the whole main reservoir pressure?

A.—No. All the main reservoir pressure must be drawn off before the valve can be cleaned. However, time and trouble may be saved by cleaning the excess pressure valve before the pump has been started and pressure gotten up.

(156) P. S., Murphysboro, Ill., asks:

Are the New York and Westinghouse air brakes in general use in England, Germany and France and other countries? If so, what system of levers do they use, the Hodge or Stevens? A.—Quite a number of Westinghouse air brakes are used in Europe and a few New York brakes. The system of levers applied on European railways is somewhat different from the systems used on our cars, but their systems abroad are usually a modification of either the Hodge or Stevens systems.

(157) E. C. P., Brooklyn, N. Y., writes:

One of our New York brake valves will sometimes carry 20 pounds excess pressure and other times 30 or 40. There is no regularity about it. Why is this? A.—The excess pressure valve is undoubtedly gummed up and needs cleaning. There is probably too much oil being used in the air cylinders of the air pump. Reduce this amount of oil used and clean the excess pressure valve, and you will probably find your trouble will disappear.

(158) R. M. W., St. Louis, Mo., asks:

Why does the red hand drop so quickly in releasing brakes with one engine and much more slowly with another, when the length of the train is the same? A.—With trains of the same length, as you mention, the difference must lie in the capacity of the main reservoir of the engine. Possibly the main reservoir on one engine is larger in volume than another. Again, the presence of water in the main reservoir may largely reduce its capacity. The smaller the capacity the quicker will the red hand drop when a release and recharge of the brakes is made.

(159) G. P. W., Lexington, Ky., writes:

Why does the 8-inch pump stop at the end of a down stroke and refuse to come up? I have taken off the cap and taken out the reversing piston, put it back and the pump would make the down stroke all right, but would refuse to reverse and come up. What is the trouble? A.—Possibly the parts need oil, and maybe the packing rings blow by badly, allowing the steam pressure to escape to the exhaust with a bad blow, instead of remaining to do its work. Particularly is this true when the pump is in a worn condition. Frequently the pump can be started by removing the plug from the lower head to let the pump start, after which the pump will proceed all right and give no further trouble until it is started up again.

(160) D. S., Murphysboro, Ill., writes:

You did not explain the McKee Slack Adjuster as I would like to know. Now, for instance, if we had a car weighing 38,000 pounds light-weight, starting from St. Louis to Mobile, light with piston travel 6½ inches. When it reaches Mobile it will be liable to have 8 inches travel, as it will have worn the shoes that much. Now, we will load the car at Mobile, and start it back to St. Louis, 640 miles. The car being loaded, the travel will be 10 inches. How many applications must the engineer make of the brakes to bring it back to the predetermined travel, namely, 8 inches? A.—In the instance cited, we will assume that the car is equipped with a slack adjuster, but has not been operating. However, upon leaving its terminal at Mobile the adjuster begins to work, and finds 10 inches of slack on the brake piston. In this case about 1-32 of an inch would be taken up at each brake application until the predetermined piston stroke or travel would be reached. Then the travel would remain at that point.

(161) O. M. E., Wilkesbarre, Pa., writes:

Will a New York pump make more water in the main reservoir than will the Westinghouse Air Pump? A.—The main causes for moisture accumulating in the main reservoir and train line are due to the heated condition of the air, the leakage of steam from the piston rods, and the vapor rising therefrom and entering the suction valves of the pump. If the New York pump does not run any hotter than the Westinghouse pump, does not leak at the stuffing boxes, and does not draw in vapor at the suction valves, the difference in the deposit of moisture between the two pumps should be inconsiderable. However, the moisture delivered to the reservoir by the New York pump is sometimes greater because of there being two stuffing boxes to leak and the consequent rising of the vapor to the suction valves. In this case the deposit of moisture in the main reservoir or train pipe would be greater with the New York pump.

(162) B. R. J., Montreal, Can., asks:

Does the graduating spring compress and expand again each time the quick action triple operates in the graduating position? A.—The very early forms of triple valves depended entirely on the graduating spring for the graduating feature, and each time the train pipe pressure was reduced in service application, the graduating snring would compress and remain compressed a certain amount until after the auxiliary reservoir had given up its amount of pressure to the brake cylinder, then the spring would expand to its normal position, thus shoving the triple piston and slide valve to lap position. Each time the brake was graduated on, the graduating spring would compress and expand. In the later form of plain triple valve and the quick action triple valve, the graduating spring does not compress. It is only compressed when full on. The piston and slide valve are moved to their full stroke in emergency application, or at the finishing put up a full service application.

(163) P. A. C., Trenton, N. J., writes:

We have a three car passenger train, all cars equipped with New York triple valves. When a service application is

made, there is a spitting, or sputtering, at the triple valve under the car, similar to the sound which happens when the brake goes into the emergency application. Does this valve vent train pipe pressure to the atmosphere in service application the same as it does in emergency application? A.—No. The New York triple does not vent train pipe pressure to the atmosphere in service application. The train pipe pressure is drawn off at the brake valve. In emergency application, however, the triple does vent train pipe pressure to the atmosphere, as you are doubtless aware. The spitting, or sputtering, of air at the triple valve under the car in service application shows that the triple, for some reason or other, has gone into quick action. This is probably due to either a harsh reduction of pressure at the brake valve, or to the small port in the inside piston of the triple being partially or wholly stopped up.

(164) E. C. P., Brooklyn, N. Y., writes:

One of our New York brake valves will set the brakes when the handle is moved from full release position to running position. Westinghouse brake valve does not do this. Will you kindly answer why? A.—Your trouble evidently comes after brakes have been released. You probably leave the brake valve handle too long in release position, allowing the main reservoir pressure to equalize with the train line pressure. When the valve handle is then moved from release to running position no more main reservoir pressure can get into the train pipe until the pump has accumulated 20 pounds more pressure in the main reservoir, or whatever pressure the excess pressure spring is set for. In the meantime if there should be any leaks in the train line the brakes will apply. The Westinghouse valve does not do this because of the special feed valve attachment which is open until the full train line pressure has been accumulated before it closes. This is the great advantageous feature of the feed valve attachment.

(165) T. T. E., Morris Park, L. I., writes:

One of our engines on a three-car train, after the pressure has been pumped up, will stand with the pump shut off. In a few moments the pump will make several strokes, then shut down again. This will keep up as long as the train stands there, the pump running for an interval and then resting awhile. I can find no leaks in the train pipe, and think when the pump is once shut down it should remain shut down until some air pressure has been used. What causes this? A.—While you have not been able to find any leakage, there is, nevertheless, leakage from the system somewhere, else the pump would remain shut down when the governor once shuts it off. There is a leak at the escape port of the governor, and possibly the check valves in the air pump leak main reservoir pressure back into the air cylinder of the pump which cannot be observed. While there appears to be no leakage there are, undoubtedly, more or less infinitesimal leaks which in the aggregate amount to considerable. These, taken together, will furnish enough total leakage to cause the pump to start up again after it once shuts down.

(166) A. B., Louisville, Ky., writes:

Why does not the reversing plate rub on the reversing valve rod and cause the pump to "jiggle" when the air pressure is low as well as it does when the air pressure is high? Two or three of our pumps do this "jiggle" act, but it is only when the governor is about to shut down the pump. My question is, why does this "jiggling" occur just as the governor is about to shut off the pump, and does not do it at the lower pressures? If the reversing plate and rod rubs at high pressure, why does it not rub at low pressure? A.—The "jiggling" referred to is not always due to the reversing plate rubbing on the reversing valve rod. When this "jiggling" is caused by this rubbing of the parts it will occur at low pressure as well as high. But when the trouble occurs as you describe, just as the pump is about to be shut down by the governor, the cause of the trouble is due to the steam pressure leaving the steam chest quickly to go to the top side of the main piston, thereby permitting the reversing piston, which has steam on it, to force the valve motion down and reverse the pump.

(167) M. F. O., Jersey City, writes:

We have the Westinghouse slack adjuster on two of our copper cars, and are experiencing some annoyance from them. The brakes on these two cars frequently stick while the others release with ease. When this train does not have these two cars in, the trouble does not occur, but as soon as they are again put in they give the trouble above mentioned. Why is this, and what should be done to overcome the difficulty? A.—Most probably the piston travel on the two cars equipped with the slack adjuster is maintained at a shorter stroke than on the other cars which do not have adjusters. As the short travel cars are always the ones which stick, it is reasonable to suppose that these cars, with the adjusters on will hang back in the release and be the last ones to let go. It is a similar case to long and short travel cars in the same train, where the long travels will go first, and the short ones afterwards. To overcome the trouble, try taking up the slack on the cars without adjustors, so that they will all have the same piston travel as the cars equipped with adjusters, and the trouble complained of will doubtless disappear.

(168) O. M. E., Wilkesbarre, Pa., writes:

We have a locomotive equipped with a New York brake valve. When we release the brakes and try to apply them again, we invariably get the emergency application. Why is this? A.—If brakes have been applied in service application, with the New York valve, and brakes are "kicked off" or released by a quick movement of the valve handle to release position, and attempt is made to re-apply the brakes by bringing the brake valve handle to the same notches that were before used, there will be no action of the brakes; because, in order to re-apply the brakes, the valve handle must go into the notches beyond those which have been used in the first application, or there will be no result obtained. The reason for this is that the first application in the first notches causes the equalizing piston in the brake valve to move toward the train pipe pressure end of the valve, where it will remain unless the brake valve handle is left in release position long enough to discharge the pressure from the supplementary reservoir. If this is not done, the notches first used are "dead." Your harsh application probably comes from over-anxiety to obtain a response from the brake valve in the first notches, and you go too far, perhaps into the emergency position.

(169) P. W. G., Jersey City, N. J., asks:

In recharging a long train, going down a long, heavy grade, should the brake valve handle be left in full release position, or in running position? Please answer and settle a controversy. A.—The brake valve handle should be left in full release position on long trains descending grades, and should be left there until the pressure is fully up to the 70 pounds standard, or, preferably, 5 or 6 pounds higher. The idea is to force the air into the auxillary reservoir as rapidly as possible in order that the brakes may again be re-applied as early as possible. By frequent recharging in this manner, the pressure in the auxillary reservoirs will reach the normal amount before all of the brake cylinder air has escaped from the retaining valves. In this way more than the ordinary ten or fifteen pounds may be retained in the brake cylinder and the highest possible pressure be maintained in the train pipe and auxiliary reservoirs. On very short trains the running position will recharge the train pipe and auxiliary reservoir rapidly enough, as the port opening through the feed valve attachments is amply large to send back pressure as fast as the feed grooves in the triple valves can take it into the auxillary reservoirs.

The Master Car Builders adopted an important paper on air brake cleaning and prices for testing, etc., at their June convention.

Clinging to Ancient Locomotives.

At various times articles have appeared in British journals praising the durability of British built locomotives and making invidious comparisons between them and the shortlived American locomotive. An extraordinary case of longevity of a British locomotive has recently come to light and we suppose it will form the text for many more comparison reflections on the locomotives built on this side of the Atlantic.

According to the London *Colliery Guardian*, one of George Stephenson's locomotives, which was placed in commission in 1822 on a railway running from the Heller colliery, Durham, to the Wear, a distance of eight miles, is still in daily use. Very little of the original engine, of course, remains, but worn parts have always been replaced by duplicates. The two cylinders are placed vertically on the top of the boiler, one above the front pair of wheels and one above the after pair. The piston rods point upward, and have cross arms from which four long connecting rods convey the power to the four wheels.

That engine will be identified as the same type as Stephenson's "Locomotion." It would hardly be conceivable that the owners of an American railroad would keep such a collection of wabbling scrap in use for so many years. The case very well illustrates the difference in policy which prevails in Great Britain and in the United States. There they seem to coddle and patch and repair a locomotive as long as it can be held together; here when an engine becomes decrepit the owner figures on the cost of a new one and sends the worn out article to the scrap heap. That is one of the secrets of our low cost of moving freight.

Reminiscences of Old Engines.

I enclose my renewal to you to-day, and wish to say that you have made your paper so interesting that it is a good deal harder to give it up than it is to pay the $2 for it.

I was pleased to see the Dickson Locomotive Erie No. 16 picture in the February Engineering. I fired that engine in the Winter of 1869-70 for William Wolcott on the Lackawanna and Bloomsburg Railroad between Scranton and remember of one wreck this engine was as smart as anything I ever put a foot on. There was one other engine on the same road, just like the Erie, she was named the James Archibald No. 20, both built by the Dickson Locomotive Works at Scranton. There were two Swinburn engines, one named Susquehanna, which was a wood burner; the other one was named Nanticoke; both were passenger engines, and both had direct valve motion, the steam chests being inside the frames under the smoke arch, and the valves stood up edgewise. There were two Norris engines, one named Wyoming and the other Northumberland. These engines had 17x24 inch cylinders and five-foot drivers, and pulled the local freight trains between Kingston and Northumberland.

There was one little engine named L. Hakes. This engine was built in the Kingston shop, and had cylinders 14x22 inches and drivers 60 inches in diameter. It also had a Milholland boiler and firebox, and was such an excellent steamer that a very young man could fire her. I remember one wreck this engine was in. She ran full speed into a flat car loaded with railroad iron, which had become detached from a train load of the same material. This train had no caboose, and nobody on the rear end. On their arrival at the terminal this one car was not missed; and as it was dark, Engineer William Robins, on the L. Hakes pulling the evening passenger train, saw the car of iron rails in time to warn his fireman, and both men jumped behind the boiler head just in time to avoid the rails from the car, twelve of which came through the cab where they had been stting when the car was seen a few seconds before. I think five of the rails entered the front end of the boiler and went through the flue sheet. The little pet engine of the road was a sorry looking piece of machinery when she was towed into Kingston, but Mr. Charles Graham, our M. M., soon put her in running order again.

I could give you a history of several engines on the old L. & B., but I guess I have bothered you long enongh for this time. The picture of the old Erie set my mind running on incidents which occurred thirty-three years ago, and in a country I have not seen for twenty-six years. C. D. CREIG.

Blaming the Locomotive for Accidents.

Blaming defects of locomotives or of brakes as an excuse for a collision is a practice known to all railway men, no matter where the railway may be or by what color of engineer the train is handled. American locomotives are to be found on nearly every railway where the sun shines, and it is not surprising to find that some of them are roasting in the Land of the Hot Sand, with Tunis for their headquarters

It seems that when an accident happens on the railway of that infidel country and the engineer proves himself an accomplished heathen liar and blames the locomotive, his word is taken for what it is worth, and an exhaustive investigation follows of a character never heard of under the Stars and Stripes

In a report made to our State Department recently Vice-Consul Touhay at Tunis says:

"A serious collision recently took place on the railway line, a short distance from Tunis, between an incoming passenger train from Algiers and an outgoing freight train The investigation of the causes of the collision developed a good deal of conflicting testimony as to who was in fault, but one engineer asserted that the origin of the whole trouble was the unmanageableness of the locomotive (of American manufacture) attached to the outgoing train. He declared that on observing the signals ol the incoming train he promptly reversed and put down brakes, but ineffectually, owing to the impetus gained by his engine.

"In order to clear up all doubts as to who was responsible for the collision it was decided to reconstitute the train in precisely the same conditions as when the accident occurred. One of the most reliable engineers on the road was put in charge of the engine, and repeated experiments proved that the train could be easily stopped at a distance of 150 feet from the spot where the collision occurred. The ease and certitude with which the huge locomotive answered the handling was considered nothing short of miraculous by the authorities of the road.

"As it is probable that important railway extensions will be effected in Tunis in the near future, this circumstance will very likely be a factor in opening negotiations for supplies of material from the United States."

Quick Measuring.

The other day a man was standing on the platform of a country station when an express was signaled.

A few minutes before it was due, he was surprised to see the whole staff of the station come on to the platform and range themselves in a line (military fashion) facing the metals. His surprise was in no way diminished when he beheld (as the train dashed through) a little, bald-headed man standing at the window of one of the carriages, evidently taking stock and making notes rapidly.

Seeing one of the porters after, he inquired: "Inspection day, I suppose?"

"Oh, no," he replied, "that's the company's tailor; been measuring us for new togs."—*Railway Times*, Queensland.

Railroad men, as a rule, are not enthusiastic concerning the benefits they have in prospect under a pension system that provides superannuation for men who have reached the age of seventy years, and have been in the service for thirty consecutive years. The pension schemes are regarded with considerable suspicion and their growth into popularity will depend very much on the way the railroad companies treat men who have been incapacitated from service through accidents. This is probably a case of "time will tell."

Crank Pin Effort.

BY IRA A. MOORE.

What is meant by crank pin effort?

It may be defined thus: It is the pull (or thrust) due to the pressure in the cylinder, on the crank pin, at right angles to the center line of the crank.

Its magnitude for any position of the crank pin may be shown by a diagram like (d) Fig. 25.

To construct the crank effort diagram it is necessary to have the indicator diagrams from the cylinder in which the work was done. If the actual diagrams are not to be had, the theoretical diagrams can be constructed and used instead, if the point of cut-off, length of stroke, point of exhaust closure, clearance and boiler pressure are known.

Diagram (d) was constructed from the actual diagrams, shown at (b), taken from an 18x24-inch cylinder and with a 60 spring. By a 60 spring is meant that it requires a pressure of 60 pounds per square inch to compress the spring that resists the movement of the indicator piston, sufficiently to raise the pencil one inch, or 90 pounds per square inch will raise the pencil 1½ inches, 120 pounds 2 inches. Hence to find the pressure in the cylinder at any point of the stroke it is only necessary to multiply the height of the diagram above the atmosphere line in inches, at the point of stroke where the pressure is to be determined by the spring, or in this case by 60, which will give the pressure above that of the atmosphere. If the net pressure is desired, that is, the forward pressure minus the back pressure, multiply the distance in inches between the forward and back pressure lines measured perpendicular to the atmospheric line by the spring.

But to return to the crank effort diagram.

For the benefit of any who may wish to know how the diagram is constructed the following explanation will be made as plain as possible:

The length of the main rod is assumed to be three times the length of the stroke of the piston, or 6 feet.

At a convenient distance below the indicator diagram draw the line in a parallel to the atmospheric line r s.

To locate the point g in (d), which represents the forward dead center, lay off from 12′ in (b), on the line m n, a distance equal to the length of the main rod; g i equals the stroke of piston to the same scale as the indicator diagram; h is the center of the driving axle and is midway between i and g. With h g as a radius and h as a center, draw the semi-circle i o c' g, which represents the path of the crank pin during one stroke of the piston.

Divide this semi-circle into any number of equal parts (12 has been used in this case) and draw the radial lines through the points of division as shown. The length of these lines cannot at this time be determined, hence they should be extended some distance outside the semi-circle.

The position of the piston in the cylinder when the crank pin occupies each of the twelve positions just located on the semi-circle must be known.

From the point l, in (d), lay off on the line m n, the distance l, 1′, equal to the length of the main rod.

Then 1′ is the position of the piston when the pin is at l. In the same way the position of the piston corresponding to any position of the crank may be found, and the points 1′—2″—7′, etc., in (b) corresponding to the crank pin positions laid off on the crank pin circle i o c' g are found in this way.

The position of the points 1 and 11, inclusive, in the irregular curve in (d) can now be found in the following manner:

Draw the lines e f and k 12′ perpendicular to m n and touching the ends of the indicator cards x' and y.

The points f and 12′ are, of course, the position of the piston when the crank pin is on the dead centers.

To find the point 3 in the curve, connect o in (d) with 3′ in (b), by a straight line.

This line shows the direction of the main rod when the pin is at o and the piston at 3′. The curve e t w in (b) represents the forward pressure on the piston, and the curve x z k, the back pressure, when the piston is traveling in the direction indicated by the arrow.

Through 3′ draw t j at right angles to m n, then as stated above, t j represents the net forward pressure on the piston when it occupies the position 3′.

On the radial line h 3 in (d), lay off the distance h p equal to t j and draw p v parallel to o 3′.

From o outward, on h 3, lay off o 3 equal to h v. The length of the line o 3 represents the turning effect of the pressure t j in the cylinder.

Perhaps this can be better understood by saying that if the axis of the cylinder was at right angles to h 3 and the line t j had the same length as o 3, the force tending to move the engine forward would be as great as the pressure represented by t j produces when the main rod has the direction represented by o 3, both t j and o 3 being to the same scale, namely, 1 inch representing a pressure of 60

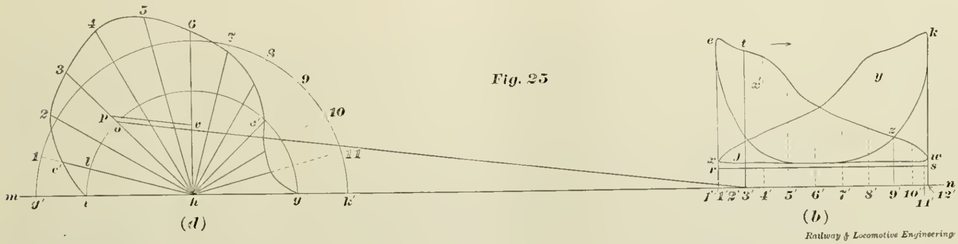


Fig. 25

(d) (b)

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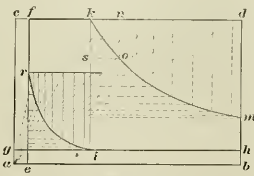

Fig. 26

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pounds per square inch of piston area. All the other points in the curve are found in the same way as 3 was.

From the intersection of the curves *e t w* and *x z k* in (*b*), to the end of the stroke, the back pressure represented by *z k* is greater than the forward pressure, which is represented by *z w*. Hence while the pin is moving from the position corresponding to the position the piston has when the curves intersect, or cross each other, to the center, the curve of tangential pressures will be inside the crank pin circle, showing that the steam in the cylinder is hindering, instead of helping, the forward movement of the engine.

To locate the point where the curve crosses the crank pin circle, draw a line through *z* in (*b*), at right angles to *m n*, then with the intersection of this line with *m n* as a center and the main rod length as radius, draw an arc across the crank pin circle (arc not shown in the figure) which will give the crank pin position sought.

In the diagram (*d*) this position is at *c*, showing that the steam is holding back on the engine during a little more than one-fourth of the half revolution of the crank pin. The diagram also indicates that the upper forward, or the lower backward eighth, is the proper place for the pin, when keying main rod brasses, since the pressure in the cylinder, at this point, is the same on both sides of the piston, consequently the pressure on the pin, due to the steam pressure is zero, at this point and the greatest diameter of the pin will be parallel to the direction of the main rod. The diagram (*d*) shows that the effect of the steam, in moving the engine, is far from being uniform.

When the pin is at *i*, or the back center, the piston is at *f* and the distance between the forward and back pressure lines, at this point, is 1.98 inches, indicating a cylinder pressure of $1.98 \times 60 = 118.8$ pounds. The diameter of the piston is 18 inches and its area is $18 \times 18 \times .7854 = 254.47$ square inches. The pull on the pin is $254.47 \times 118.8 = 30{,}231$ pounds, but this force only pulls the driving box against the pedestal jaw and has no effect whatever on the traction of the engine.

When the pin is at 1 and the piston at 1', the cylinder pressure and pull on the pin are practically the same as before, but the force now has the same effect on the movement of the engine as if the pin were on the quarter and the cylinder pressure were represented by a line equal in length to *l e*, which length is .46 inch, representing a pressure of $.46 \times 27.6$ pounds per square inch, or, in other words, if the pin were on the quarter and the cylinder pressure were 27.6 pounds, the engine would start as many cars as it will with the pin at *l* and a cylinder pressure of 118.8 pounds.

Again, the diagram shows that the pin is making its greatest effort when it is about midway between the upper back eighth and the top quarter, or in the corresponding position when the pin is below the center of axle.

The semi-circle drawn outside the crank pin circle represents the average effort on the pin. The distance *g' i* is equal to the length of a line representing the mean effective pressure in the cylinder, multiplied by $\frac{2}{3.1416}$.

The method of constructing the theoretical diagram, shown in Figure 26, from the same cylinder, and with the same point of cut-off and exhaust closure, as diagram *x'* in (*b*), will now be described. Let 1 inch of the length of diagram = 6.78 inches, of stroke of piston and clearance = 8 per cent. of the stroke; 1 inch of the height = 60 pounds per square inch. Boiler pressure is 145 pounds absolute.

Then the length of *e b*, which represents the stroke, is $\frac{24}{6.78} = 3.54$ inches and the length of *a e*, which is the clearance, is $3.54 \times .08 = .28$ inch. Draw the line *a b* and make its length $3.54 + .28 = 3.82$ inches. At *a*, erect the perpendicular *a c*. To find the height *a c*, divide the absolute boiler pressure by the spring of indicator. By absolute pressure is meant pressure above vacuum and it is equal to the pressure shown by the gage, plus 14.7. Hence the height of the diagram at *a c*, above the vacuum line is $\frac{159.7}{60} = 2.62$ inches. Through *c* draw *c d* parallel and equal to *a b*, and *d b* parallel to *a c*; *k* is the point of cut-off, which takes place at 7 inches and since 1 inch of the length of diagram represents 6.78 inches of stroke, *f k* is .97 inch; *g h* is the atmospheric line and is $\frac{14.7}{60} = .24$ inch above *a c*.

To find the points through which the expansion curve *k o m*, is drawn, draw a number of lines from *a*, across *k d*; *a s n* is one of these lines. From *n* draw *n o* at right angles to *a b* and from *s* draw *s o* at right angles to *c f*. Then *o* is a point in the curve.

Any number of points can be located in the same way. To locate the points in the compression curve in this way, the pressure at the end of compression must be determined.

The indicator cards shown in Fig. 25 show that the exhaust closes at 16 inches of the stroke, or at *i*, Fig. 26.

The volume of steam to be compressed is *g i* or 2,519.25 cubic inches, and its pressure *a g*, or 14.7 pounds. At the end of compression the volume is *a e*, or 483.4 cubic inches.

The pressure at end of compression is

$$\frac{2{,}519.25 \times 14.7}{483.4} = 76.6 \text{ pounds}$$

and *r* is $\frac{76.6}{60} = 1.27$ inches above *c*. The volume *a c* and the pressure *c r* of the compressed steam are now known and the curve *r i* can be drawn in the same manner as the expansion curve.

Cedar Rapids, Iowa.

Rules for Examination of Car Inspectors

The report of the committee on this subject to the Master Car Builders' Convention, deals principally with the tests of eyesight and hearing. The color test is advised as a matter of record, but the committee does not believe that an inspector should be rejected on account of defective color sense. There are nineteen questions submitted, as samples of the kind which should be put, in examining an inspector on the M. C. B. rules. The inspector should have sufficient education to enable him to write legibly and he should be able to read manuscript as well as printed matter.

There is a practical mode of test, not mentioned by the committee, which would determine, relatively at least, a man's powers of observation, which is something quite different from simple normality of vision. A car having four or five defects, which come clearly within the operation of the M. C. B. code, might be selected by the examiner. The candidate might then be required to find as many of them as he can. The severity of this test could be increased by shortening the time given in which to find the defects.

High Water Engines Planned.

The railroads which are blocked at certain places by high water two or three times every year have about decided to build wading engines. Superintendent of Motive Power L. H. Turner, of the Pittsburg & Lake Erie, is a genius, says the Pittsburg *Post*, and to obviate the trouble at Saw Mill run he is about to get up a unique engine. This machine will be placed on four high wheels (driving wheels) with the fire box so arranged that it will occupy part of the diameter of the boiler and be almost as high as the wheels, which can be made seventy inches in diameter. Such an engine could pull passenger coaches through water that might reach the floors. Mr. Turner has no plans for this monstrosity to make public, but he admits that it could be called an amphibious locomotive. Mr. Turner could build a successful amphibian if he was ordered to do so. He will insist however, that such an engine could be called with much more scientific propriety a batrachian.

Apparent Disappearance of Energy.

If a clock spring is wound up fully and fastened so that it cannot unwind there is a certain amount of energy stored up in it. If the spring so set, is placed in a bath of strong acid capable of slowly eating up or dissolving the material of the spring, what becomes of the stored energy?

Vauclain Compound for the Choctaw, Oklahoma and Gulf.

We illustrate herewith a Baldwin compound consolidation engine, one of 12 which has recently been built for the Choctaw, Oklahoma and Gulf Railway. The fuel which these engines have to burn is of very inferior quality, and this fact counts for the Wootten firebox and the centrally placed cab. In the language of the road, however, these engines are "dirt burners." They have given excellent results in service. The cylinders are 15 and 25 x 26 inches, and the driving wheels are 56 inches in diameter. As can easily be seen from the half-tone, the general design of the engine is neat and symmetrical, and the disposition of injectors, reservoirs, etc., appears to be very satisfactory. The tank is carried on a steel underframe and has a capacity of 5,000 gallons. The principal dimensions are as follows:

Gauge—4 x 8½ inches.

Cylinder—15 and 25 x 26 inches.

Valve—Balanced piston.

Boiler—Type, Wootten, straight; diameter, 66 inches; thickness of sheets, $\frac{11}{16}$ inches; working pressure, 200 pounds; fuel slack coal; staying, radial.

Firebox—Material, steel; length, $105\frac{1}{16}$ inches; width, 96 inches; depth, front, 61¼; back, 48¼; thickness of sheets, sides, ⅜ inch; back, $\frac{5}{16}$ inch; crown, ⅜ inch; tube, ½ inch; water space, front 4 inches; sides, 3½ inches; back, 3½ inches.

Tubes—Material, iron; wire gauge, No. 12; number, 241; diameter, 2¼ inches; length, 14 feet 3½ inches.

Heating surface—Firebox, 174.6 square feet; tubes, 2,016.8 square feet; total, 2,191.4 square feeet; grate area, 70 square feet.

Driving Wheels—Diameter outside, 56 inches; diameter of center, 50 inches; journals, main, 9 x 8½ inches; others, 8 x 8½ inches.

Engine Truck Wheels (Front)—Diameter, 29¼ inches; journals, 5 x 8 inches.

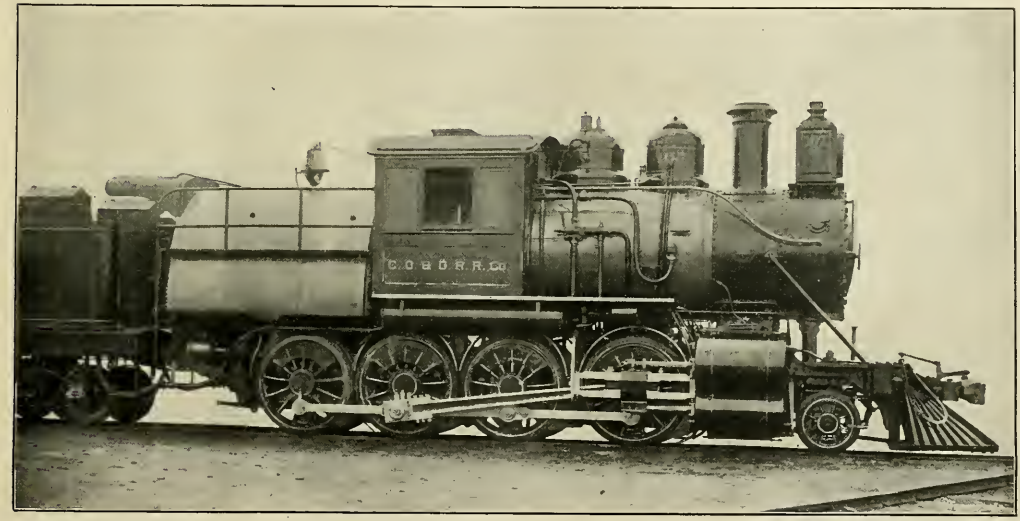
Wheel Base—Driving, 15 feet 0 inches; rigid, 15 feet, 0 inches; total engine, 23 feet 1 inch; total engine and tender, to turn on 60 foot table.

Weight—On driving wheels, 142,490 pounds; on truck (front), 19,380 pounds; total engine, 161,870 pounds.

Tank—Capacity, 5,000 gallons.

Tender—Wheels, No. 8; diameter, 33 inches; journals, 4¼ x 8 inches.

Service—Freight.



CHOCTAW, OKLAHOMA & GULF LOCOMOTIVE.

Mexican English.

A wiper in a Mexican railway roundhouse took it in his head that he could handle an engine and without having authority he proceeded to try his hand, with the result that he bumped against the roundhouse wall and knocked the pilot off. For that he was discharged, and he sent the following amusing letter to the master mechanic in charge, whose name is Kidd:

"Good morning Sir how do you do Mr. Keed. I am glad to see you well. I am much obliged to you. Mr. Keed ask you this, it is a mistake you are deceived. upon my honor. that cannot be. I deny the fact and will lay it is not. this is a false. How unfortunate I am. I am what a shame for me. I Know not whether I am asleep or awake. Mr. Keed, why do you not Give my time. I will thank you for my time. I am very much obliged to you what you look my time and Send it to at Castano. the Sr. faustino de Hoyos, and he Sr. f. Give me the time and. if not I come at the Station of castano for my time you will oblige me very much. do not refuse me your assistance I pray you. I Shall be be very grateful. pray don't forget me. Mr. Keed....I am much obliged to you."

Santiago de Laray.

Pneumatic Tools for Clyde Shipyards.

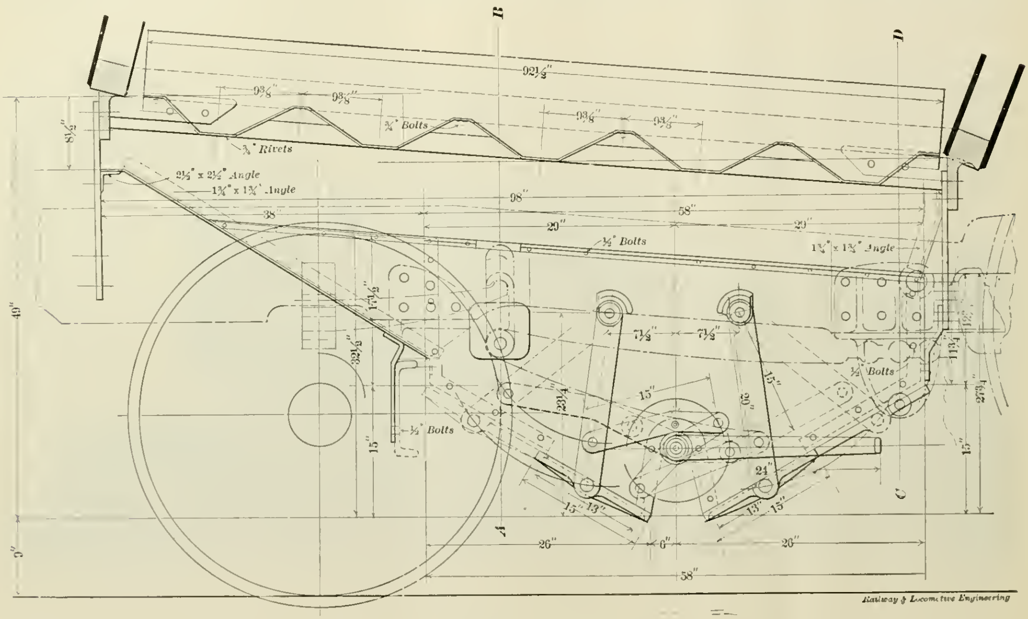
We learn from a Glasgow paper that the ship builders of the Clyde are waking up to the truth that they must use improved methods of working or fall out of the industrial race.

The secretary of the Clyde Shipbuilders' Association, in conjunction with Messrs. John Macdonald & Sons, local agents for the Chicago Pneumatic Tool Company, which was recently amalgamated with the Tait-Howard Pneumatic Tool Company, have arranged for a six weeks' trial of pneumatic tools of all kinds in the yards of Messrs. Scott & Co., Greenock. Three of the best American workmen from Chicago will, along with three of Messrs. Macdonald's men, start work in Messrs. Scott & Company's yard on Wednesday.

The tools operated will be those used recently on the American liner Zeeland at Southampton, and later on the Cunard liner Etruria at Liverpool. A new stern piece was put on the Cunarder, which required 1½-inch rivets through 9 inches of material, one of the heaviest jobs that have been done either by hand or machinery.

At Messrs. Scott & Company's yard

the work will be mostly on a merchant vessel of 8,000 tons. All kinds of shipyard work will be done—shell riveting, deck riveting, caulking, chipping, boring and reaming—so that all the different kinds of pneumatic tools will be experimented with. Practically all the leading shipbuilders in Great Britain have accepted the invitation of the Clyde Shipbuilders' Association to visit the yard while the work is being carried on, and arrangements have been made for having a specified number of them present each day of the six weeks, so that they may all have an opportunity of judging for themselves as to the merits of the work done by pneumatic tools.



PLAYER ASH PAN.

Player's Improved Ash Pan.

A gravity door-closing ash pan suitable for wide fire box engines has recently been designed and patented by Mr. John Player, of Chicago. The upper part of the pan is made of sheet steel and is connected to the mud-ring in the usual manner. Each of the discharge doors is hung in the center, to links which are attached to the ash pan sides. A shaft passing under the center of the pan is operated from the cab. This shaft is attached to the door hangers, and a quarter turn of the shaft causes the links to assume the position shown by the dotted lines in the illustration. The doors are slid up each way close under the pan clear of the openings. The action of gravity tends to keep the doors always positively closed, without reference to the weight of the material in the hoppers. As far as the doors are concerned, the ash pan should be thoroughly air-tight.

Conservative Enginemen.

"An Expert," writing in the *Madras Mail* on English and American locomotives, tells the following amusing anecdote: "Locomotive drivers, it is generally admitted, are one of the most conservative types of men in this world. They are not less thought of for this characteristic, which is a desirable trait in many ways, though possibly disadvantageous in others. I recollect a case of this extraordinarily conservative spirit. On a certain railway it was found necessary, owing to the introduction of some inferior coal, to use brick arches in the fireboxes. The result of the innovation was that every engine on the system lost time in a most hopeless manner, and it was a common experience for engines to stick between stations for want of steam. These complaints lasted, not for a few weeks or months, but more than a year. The officials of the railway refused to give way to the drivers' entreaties that the brick arches should be removed, and brick arches were used from that time forward. In the course of time matters righted themselves, the drivers got used to the brick arches, and trains kept time. About five years after the introduction of the brick arches the supply of bricks, owing to an accident, ran out, and, as a consequence, for several months many engines had to run without brick arches. The result was unexpected. Loads had to be reduced, engines would not steam, traffic and trains were delayed, and the whole railway appeared to be more or less in a disorganized state. The excuse in every case, given, I believe, in perfectly good faith, was that it was impossible to run engines without brick arches. It is this conservative spirit that makes one hesitate to accept drivers' statements and opinions concerning English and American engines. If American engines were exclusively used on an English line sufficiently long to enable drivers and the staff generally to grow up with them, it would probably be found that an English engine would not be kindly received on that railway. The converse, of course, would no doubt be equally true."—*English Mechanic.*

Passenger Cars with Cupolas Like Cabooses.

The C. P. R. is constructing at its Hochelaga shops, Montreal, an observation car for service in the Rocky and Selkirk mountains. It will be 56 feet in length over frame, with seating capacity in the body of the car for 14 passengers, and with a cupola at each end that will seat six passengers each. It will be provided with revolving chairs, and the windows will be made as large as possible. If it proves satisfactory the company will probably build additional cars like it.

Of Personal Interest.

Mr. Louis Wellisch has been appointed master mechanic of the Louisville and Atlantic Railway at Richmond, Ky.

Mr. E. W. Gregory has been appointed master mechanic of the Rockdale Railroad with headquarters at Hoffmanville, Md.

Mr. W. A. Brown has been appointed master mechanic of the Central New England Railway with headquarters at Hartford, Conn.

Mr. Louis W. Hill has been elected president of the Spokane Falls and Northern Railway with headquarters at St. Paul, Minn.

Mr. H. Baker has been appointed superintendent of the Charlotte Division of the Southern Railway with headquarters at Charlotte, N. C.

Mr. A. T. Perkins has been appointed superintendent of the Kansas City, St. Joseph and Council Bluffs Railroad with headquarters at St. Joseph, Mo.

Mr. N. J. O'Brien, superintendent of the Greensboro division of the Southern Railway, has resigned to accept a position with the Long Island Railroad.

Mr. W. J. Wilcox, master mechanic of the Mexican Central Railway, has been transferred from the City of Mexico to Monterey, vice B. B. Horrop resigned.

Mr. H. J. Beck has been appointed road foreman of engines on the Lebanon Division of the Philadelphia and Reading Railway with headquarters at Reading, Pa.

Mr. H. C. May has been appointed master mechanic of the Louisville division of the Cleveland, Cincinnati, Chicago and St. Louis, with headquarters at Louisville, Ky.

Mr. Jos. Clare has resigned his position of general foreman of the Cincinnati, Hamilton and Dayton Railway to accept one on the Clover Leaf, at Frankfort, Ind.

Mr. R. H. Dwyer has been appointed superintendent of terminals of the St. Louis, Iron Mountain and Southern Railway with headquarters at Little Rock, Ark.

Mr. Joseph B. Stewart has been appointed superintendent of the Boston and Albany Railroad at Boston, Mass. He was formerly chief trainmaster of the same road.

Mr. David Meadows has been made general road foreman of engines of the Michigan Central Railway, at St. Thomas, Ont. He was formerly traveling engineer of the same road.

Mr. William B. Leeds has been elected president of the Choctaw, Oklahoma and Gulf Railway. He holds the same position on the Chicago, Rock Island and Pacific Railway also.

Mr. P. T. Bauman has been appointed general superintendent of the Tennessee and North Carolina Railway at Newport, Tenn. Mr. Bauman was formerly agent on the Southern Railway.

The business of the Gold Companies has increased enormously during the past few years, and now extends all over the world, wherever railway cars are operated by steam or electricity.

Mr. Chas. Wincheck, general foreman of the locomotive department of the Santa Fe Pacific Railway, has been appointed master mechanic of the Mexican Central Railroad with headquarters at Mexico City.

Mr. S. E. Crance having resigned the position of general superintendent of the Hannibal and St. Joseph Railroad, at St. Louis, Mo., the duties of that office will be assumed by Mr. C. M. Levey, general manager.

Mr. James Rowland Bibbins has resigned as Assistant Electrical Engineer of the Detroit United Railway to accept a position in the Westinghouse Company's Publishing Department, Pittsburg and New York.

Mr. Alexander Stewart has been appointed master mechanic of the Wyoming division of the Union Pacific Railway with headquarters at Cheyenne. He was formerly foreman of the Cheyenne shops of the same road.

Mr. Samuel M. Nicholson has been elected president and general manager of the Nicholson File Company, the largest file and rasp concern in the world, which controls six large plants, with home offices at Providence, R. I.

Mr. E. H. Coapman has been appointed superintendent of the Danville division of the Southern Railway with headquarters at Greensboro, N. C. Mr. Coapman was formerly trainmaster of the Santa Fe Pacific at Needles, Cal.

Mr. James F. Walsh has been appointed superintendent of motive power of the Chesapeake and Ohio Railway with headquarters at Richmond, Va. Mr. Walsh has for a number of years past been with the Galena Oil Company as mechanical expert.

Mr. H. P. Greenough, vice-president of the Rock Island and Peoria Railroad, has been appointed assistant superintendent of the Illinois division of the Chicago, Rock Island and Pacific, of which the Rock Island Peoria is now a part. Headquarters Rock Island, Ill.

Mr. J. G. Metcalfe, general manager of the Evansville and Terre Haute Railway has been made president of the Mexican International. Mr. Metcalfe was for many years connected with the Louisville and Nashville Railroad as superintendent and later on was appointed general manager.

Mr. F. E. Place has been appointed master mechanic of the Burnside Shops of the Illinois Central Railway. He entered the service of this company in 1884 as clerk and has served consecutively as machinist apprentice, machinist, foreman of engine house and general foreman up to the position he now holds.

Mr. Edwin Manchester has been appointed traveling engineer of the Missouri, Kansas and Texas Railway at Sedalia, Mo. Mr. Manchester is an engineer of wide and varied experience in freight service and an expert in handling long, heavy freight trains over rolling country. The appointment gives general satisfaction and is a deserved tribute to meritorious service.

Mr. David Briggs, general foreman of the Louisville and Nashville shops at Montgomery, has been appointed master mechanic of the same road at Anniston. Mr. Briggs has been general foreman of the Montgomery shops for a little over a year and has made many warm friends who will be sorry to lose him although glad to see him advanced. He is the son of R. H. Briggs who was at one time president of the Master Mechanics' Association and who is now master mechanic of the Frisco System at Memphis, Tenn.

Mr. W. R. McKeen has been promoted from the position of master mechanic to that of superintendent of motor power of the Union Pacific Railroad with headquarters at Omaha, Neb. Mr. McKeen went to the Union Pacific four years ago from the Vandalia Line to take the position of general foreman at North Platte, and was promoted about a year ago to be master mechanic at Cheyenne. His father was for twenty-nine years president of the Terre Haute & Indianapolis Railway and he has a brother a superintendent on the Vandalia Line. Those who are acquainted with Mr. McKeen predict for him a very successful career in railroad life.

Mr. S. Higgins, who left the position of Superintendent of motor power of the Lehigh Valley Railroad about a year ago, to accept a similar position on the Union Pacific, has resigned to go to the Southern Railroad as general superintendent of motor power. Mr. Higgins was one of the first of our engineering school graduates to commend himself for promotion

on his attainment as a practical mechanic After leaving college he went into a machine shop and passed through the grades of apprentice, journeyman, foreman and from that to be division master mechanic, then assistant superintendent of motor power, all of which happened on the Erie. An objection which we have found to many engineering school graduates in railway work has been, that too few of them have displayed willingness to pass through the course which has made Mr. Higgins one of the most efficient motor power officials in the country.

Mr. Alexander Stewart has been promoted from general foreman to master mechanic of the Cheyenne shops of the Union Pacific. The *Cheyenne Leader* says:

"No more able or efficient official on the Union Pacific could have been secured to fill this important post. Mr. Stewart learned his trade with the Union Pacific and has steadily risen by merit to the position he now holds. He went to work for the road in 1882, entering the shops as a machinist apprentice until he learned his trade in 1885, when he left for the east to study in a school of mechanics until 1890, when he returned to North Platte and again went to work as a machinist. In 1897 he was promoted to the position of district foreman at North Platte and was successively district foreman at Sidney, Neb., in 1898; Laramie, in 1899; Evanston, in 1900, and again foreman at North Platte in 1901. On June 20 of last year, he was promoted to his present position."

Lord Kelvin.

Professor Crocker tells us that the part played by Lord Kelvin in connection with the laying of the Atlantic cable is undoubtedly his strongest claim to high rank in the history of science and engineering. He possesses a twofold mental makeup which was clearly exhibited in his work in connection with the cable. His mathematical knowledge and ability is of the very highest order, and it is, strangely enough, combined with the greatest amount of common sense and practical faculties. He not only has carried on scientific research in abstruse and abstract fields, but he is also a man who can "do things." He has accomplished practical results from the application of scientific discoveries. Among his many achievements may be mentioned his reflecting galvanometer, ampere balance, electrometers, siphon recorder, marine compass and deep-sea sounding apparatus. His ideas and methods are original. He always views any subject distinctly from his own standpoint, and without prejudice.

We find that a great many railroad officials take an active part in automobiling, and some of them are prominent members of automobile clubs.

What the Engines Said.

At the time of the completion of the rail connection between the Atlantic and Pacific, Bret Harte wrote the following poem which will be read with new interest on account of the poet's sudden death:

What was it the engines said,
Pilots touching—head to head—
Facing on the single track,
Half a world behind each back?
This is what the engines said,
Unreported and unread.

With a prefatory screech,
In a florid Western speech,
Said the engine from the West:
"I am from Sierra's crest;
And, if altitude's a test,
Why, I reckon it's confessed,
That I've done my level best."

Said the engine from the East:
"They who work best talk the least,
S'pose you whistle down your brakes;
What you've done is no great shakes;
Pretty fair—but let our meeting
Be a different kind of greeting;
Let these folks with champagne stuffing,
Not their engines, do tne puffing.

"Listen! Where Atlantic beats
Shores of snow and summer heats;
Where the Indian autumn skies
Paint the woods with wampum dyes;
I have chased the flying sun.
Seeing all he looked upon—
Blessing all that he has blest—
All his vivifying heat,
All his clouds about my crest.
And before my flying feet,
Every shadow must retreat."

Said the Western engine, "Phew!"
And a long, low whistle blew.
"Come now, really that's the oddest
Talk for one so modest—
You brag of your East! you do?
Why I bring the East to *you*.
All the Orient!—all Cathay—
Find through me the shortest way.
And the sun you follow here
Rises in my hemisphere.
Really—if one must be rude—
Length, my friend, ain't longitude."

Said the Union: "Don't reflect, or
I'll run over some director."
Said the Central: "I'm Pacific,
But when riled I'm quite terrific.
Yet to-day we shall not quarrel,
Just to show these folks this moral,
How two engines—in their vision—
Once have met without collision."

That is what the engines said,
Unreported and unread.
Spoken lightly through the nose,
With a whistle at the close.

We have ready for delivery Sinclair's new book on "Firing Locomotives." It is a convenient book for the pocket, contains plain instruction on combustion of fuels and costs only 50 cents.

Valve Motion Model.

Every ambitious engineman and railroad shopman wishes to learn how the valves of locomotives operate to admit steam to the cylinders.

There is no easier way to learn that than to watch the movements of valve and piston in a model. If the model can be purchased so cheaply that every man wanting to learn can keep it in his own home so much the better, for he is likely to experiment with it often.

We sell a small valve motion for $10.00. It is a working model and is suitable for parlor or library table, is an ornament to such a place, and, although only 16 inches long, is as complete as the large models sold for about $100. Has slide valve and piston working in the cylinder, with ports and steam passages plainly shown. There is a main rod, driving wheel, a shifting link, and two eccentrics with their straps. The eccentrics are movable and permit a learner to practice on the setting of the valves.

If you want the model and cannot spare the money, a little work in securing 24 subscribers for RAILROAD AND LOCOMOTIVE ENGINEERING will entitle you to become owner of this very useful apparatus.

Overheating Boilers.

In a paper on the overheating of boilers prepared by Mr. C. E. Stromeyer and presented before the Institute of Naval Architects, two effects of high temperature on the metal of the boiler are considered. One is the internal effects, due to the temperature gradient in the thickness of the metal. The other is the action of the pressure modified by distortion caused by change of shape. An internally fired furnace, he tells us, of 40-inch internal diameter, clean and free from scale or grease, will be distorted so as to measure about 41 inches along its horizontal diameter, while the vertical diameter will become about 39 inches.

In dealing with the effects of scale and grease Mr. Stromeyer assumes that scale 1-10 of an inch thick offers as much resistance to the passage of heat as a film of grease does when about 1-100 of an inch thick. These resistances are comparable, he shows, to that of a plate of steel 10 inches thick.

If these figures are anything like correct, we can only say that the frequent washing out of boilers is not only a very important means of boiler preservation, but it vitally affects the economical value of the boiler's evaporative performance.

Pensions for Employees on the Intercolonial of Canada.

A plan for providing pensions for employés of the I. C. R. who have been 40 years in the service has been elaborated at Moncton, and will be laid before Parliament during the session.

M. C. B. & M. M. Convention Notes

President Hennesy proved an ideal presiding officer, being able at all times to keep accurate record of business, quick to observe and to act, and to speed the convention work without slighting it. This being his first year in the chair, he has proved by his admirable presiding, that two years in the chair is not necessary to produce an able chairman, and that natural ability will reach further in such work than artificial training. The one year rule is a good one, and will permit a larger number of deserving men to occupy the chair.

President Hennesy's address to the convention was a clear, concise review of the past year's progress in M. C. B. matters and probabilities of future contingencies. He had the matter well in hand and was therefore able to make numerous suggestions, which, if acted upon, cannot help but add to the valuable work of the M. C. B. Association and redound to the benefit of the railroads which the association serves.

A High Official Commends the Mechanical Conventions.

Most of the railroad men who attended the railroad mechanical conventions at Saratoga, got there without much difficulty about transportation; but some of them had to go by roundabout routes. Those who refuse to admit that the members of the associations are entitled to transportation courtesies, take a very narrowminded view of the case. Mr. I. D. Underwood, president of the Erie, took a stand in the granting of transportation that ought to have shamed a good many railroad managers. He was not backward in urging that the members of the Master Car Builders' and of the Master Mechanics' Associations were entitled to all the courtesies that railroad companies could grant them. He said that these associations had done valuable work which resulted in making the repairs of cars and locomotives less costly to railroad companies. That all the standards which did so much to facilitate the movement of freight cars, were proposed and established by the labors of the mechanical associations and that that work alone entitled the members to the favor and good will of railroad companies.

M. C. B. Standards and Recommended Practice.

The M. C. B. Committee on the Supervision of Standards and Recommended Practice of the Association approved the suggestion of the Central Railroad Club, which is that the letters "A" and "B" shall be stenciled on either end of all cars. This is done to facilitate the correct making out of defect cards. The B end of the car is the brake staff, and in case a car has two brake staffs, the B end is the one toward which the brake cylinder push-rod travels.

Under the head of "Handholds," a representative of the Interstate Commerce Commission called attention to the great variations in heights of handholds, and suggested that a more definite location should be specified for these handholds, and that more attention should be given to correctly locating them.

The committee recommended that in each place where the location is mentioned, it be changed from reading "about twenty-seven and one-half inches above the center line of drawbar" to read "not less than eighteen inches, nor over thirty inches, above center line of drawbar."

The remarks of Secretary Mosely, of the Interstate Commerce Commission before the convention proved that the committee is on the alert in railroad doings, and that it believes a friendly source of reliable information lies in the mechanical railway conventions. He spoke freely and frankly of the service of his commission, and expressed a desire to co-operate with these associations to the end of securing reliable railroad data and information rather than antagonize and oppose in its work. That this feeling was reciprocated was evidenced by the speaker's reception by the convention.

The pass restriction visably affected the attendance at the Saratoga convention this year. While many roads have paid the railroad fare of their representatives, still there are some roads which have kept their men at home rather than pay it. The convention assembled, passed a resolution that a request be made of the Passenger Association to remove the anti-pass exchange restriction from the railroad men attending the railway mechanical conventions. It is hoped that the request will be honored; for nothing has so contributed to the phenomenal progress of the American railroads as the conventions of the mechanical railway associations. It would certainly seem that a reconsideration of the anti-pass agreement could be advantageously had, since the result of the agreement has been seen to most seriously affect railway men, and slightly, if at all, does it affect those at whom it was aimed.

Joint Work of the Railway Mechanical Associations.

It is eminently satisfactory, says the *Railway Age*, to note the unaffected relations existing between the various railway associations, as evidenced by the action taken in the consideration of the report on cleaning air-brake parts and the prices to be charged therefor. The committee (Master Car Builders) called to its assistance in matters of detail a delegation from the Air Brake Association, its members were given the privileges of the floor of the convention and, what is more to the point, the remarks of its spokesman were listened to with interest and instruction. There is evidently a disposition on the part of the members to modify to some extent the conclusions expressed previous to the consultation. This is as it should be. Both associations are in many lines working toward the same end. It neither derogates from the dignity of the association of higher officials nor has any tendency to magnify the influence of the younger association beyond reasonable bounds. They can work together to mutual advantage and to the benefit of the railways by which the members of both are employed.

Air-Brake Association.

The Air-Brake Association is an organization brought into existence through the desire of various men engaged in taking care of air brakes on a few of the leading railroads in the country. Keeping air brakes in good working order and finding out the cause of defects gradually became specialties that were understood only by those immediately in charge of the brakes, and it was natural that these men should desire to meet periodically for the purpose of exchanging accounts of experience. An association with that object in view was formed in 1894 and it has proved one of the most useful mechanical organizations in existence. The influence of the association in promoting the efficiency of air brakes has been very great indeed and seldom has received the recognition deserved.

The declared object of the Air-Brake Association is "by co-operation with the other railway associations, to furnish such information concerning the construction, best methods of operating, defects resulting from service, and most approved means of maintenance of air brakes as will contribute to the maximum of brake efficiency at the minimum expense." That these declarations have been faithfully fulfilled is known to all railroad men connected with train operating and a multitude of troubles have been avoided by the faithful work of the members of the Air-Brake Association. In some respects this association shows an example to others that would be well worthy of imitation. Their conventions are noted for the close attention devoted by the members to the business of meetings. They accept no favors or entertainment from supply men but pay the expense incurred for the entertainment of their friends and this year not a few of them had to pay railroad fare part of the way to Pittsburg where the annual convention was held. It is to be hoped that the railroad companies for which these people work will refund the money expended in the effort to increase the efficiency of air brake equipment.

The Consolidated Railway Electric Lighting and Equipment Company.

A very enjoyable trip for invited guests, going to the M. C. B. convention, was provided by the Consolidated Railway Electric Lighting & Equipment Co., of New York, in a private car which was attached to the "Buffalo Limited." Apart from the fact that this car was the one used by H. R. H. Prince Henry of Prussia, it is most thoroughly equipped with the Axle light system which is used by this company. This system, in common with all others which derive power from a revolving axle, has the advantage, that it can be used on any railway which can haul the car. No attachments to engine or other cars are necessary. The generator is a bi-polar, shunt-wound dynamo, driven by a flat rubber belt, from a pulley clamped to an axle. This dynamo is placed on the truck. It is able to swing to and from the axle by being mounted on a rocker shaft, and the ability to move in this direction allows for the up and down motion of the truck. As it is fastened to the truck frame it can at all times swing with the truck. It is equipped with spring device for maintaining a constant tension on the belt. The motions of the truck and the stretch of the belt are thus provided for. The life of the belt is said to be from 30,000 to 75,000 miles. The belt and pulleys are covered with a sheet iron case having dust guards around the axle. The machine is equipped with self-oiling and self-aligning bearings.

A very ingenious device for maintaining, what electricians would call the constant polarity of the dynamo, is in use here. The armature shaft carries a worm, operating a gear cam, which throws a switch when the direction of rotation of the armature is reversed. In other words, no matter which way the car may run, a positive current is supplied.

The use of electricity for passenger car lighting has been recognized in Europe for many years as a very desirable system, probably among other reasons, because there is very little heat generated, and no odor is produced, by these lights the air which passengers breathe is not vitiated and the safety, in case of wreck or disaster, of electric lighting is beyond question. In the matter of simple convenience the electric system is certainly entitled to some consideration, because each light can be placed just where it is of the most use to the passenger. In addition to the clear story lights, lamps may be provided, if one may so say, almost for each individual reader, and in sleeping car berths, lights can be so arranged that after retiring, a passenger may read without illuminating the car to the annoyance of his fellow passengers, or he may flash on a momentary glow at night and ascertain the time, or find a missing handkerchief. One of the applications of electricity which appeals to the traveling public is the use of electric fans. Great comfort is experienced, especially during the heat of the summer by the use of fans which keep the air of the car in constant motion. A fan, however, consumes about as much current as three incandescent lamps, and in sleeping cars some of them can be used on hot nights with advantage when the lamps are all out.

Within the car, contained in a suitable cabinet or locker, is installed (in any convenient location) the automatic regulator. This little piece of mechanism operates automatically to vary the resistance in the field circuit of the generator, to correspond with varying train speeds. The output of the generator is thus maintained constant for all train speeds above what is called the "critical speed." The critical speed is simply that at which the generator begins to deliver sufficient current to the car, and below which little or no effective current flows. The critical speed on through trains is from 12 to 15 miles per hour. The regulator has for its principal function the regulation of current. First to charge the storage battery, when the car is in motion, with light and fan system not in use. Second to control the supply for lights and fans with current, when the car is in motion, with either or both of these circuits in use. Thirdly it regulates the supply of supplemental battery current, to assist the direct dynamo current, when taxed by the use of all the lights and fans at once; and fourthly it adjusts the flow of direct or battery current to maintain steady lighting, etc., when the train is starting or stopping or standing still. The mechanism by which these various results are obtained is very ingeniously constructed. It contains a switch which automatically connects the generator in multiple, with the storage and lamp circuits at the critical speed. The lamps are always connected with the storage battery, so that current of proper voltage is always supplied to them. The voltage maintained is about thirty, and this permits the use of lamps which have short strong filaments, admirably adapted to railway service. The full number of lights in each car can be maintained for 10 hours without the car being moved. The batteries are known as the Chloride Accumulator type. Upwards of thirty-one of the leading railroads in the United States and Canada, are using this system, either separately or in conjunction with well-known systems of lighting, not depending upon the motion of the car.

Although the Atlantic Brass Company, of New York, did not have an exhibit at the convention, the company was represented by Messrs. Bosworth and Cooper who were busy answering enquiries concerning the A. B. C. self-adjusting car journal bearing. The idea in designing this bearing was to produce a brass and wedge which, while conforming to the M. C. B. standard, should, at the same time, evenly distribute the load along the center line of the journal.

The exhibit of the National Car Coupler Co., of Chicago, contained specimens of the National steel platform and buffer for passenger cars. The Hinson friction draw gear and the Hinson draw gear attachment, also the National freight car coupler. Mr. J. A. Hinson, president of the company, and Mr. J. G. Sanborn were on the ground.

Mr. A. O. Norton, of Boston, Mass., exhibited his ball bearing lifting jacks, track jacks and handy compact little journal-box jacks. Mr. Norton has a branch establishment in Canada.

The American Steel Foundry Company, of St. Louis, Mo., exhibited models of its trucks and bolsters, and was represented by Mr. J. V. Bell. This company makes basic open hearth steel castings and builds steel cars of all kinds. The American steel truck is one of its specialties.

The Kindl Car Truck Company, of Chicago, in addition to its own patents now controls those of the Cloud arch bar and Pedestal trucks. Models of the trucks were on exhibition at the Saratoga convention. The Kindl truck is made from standard rolled shapes, and the company claim to give a car inspector a chance to do intelligent work.

The Crosby Steam Gauge & Valve Co., of Boston, Mass., had on exhibition a complete assortment of Crosby spring seat globe and angle valves, locomotive plane and muffled pops. Improved locomotive gauges, in which no solder is used, neither are the joints brazed. The improvement, which is applicable for high pressures, is a screwed tip and screwed socket at either end of the two branches of the expansion pipe. The original Crosby chime whistle, the Johnson blow off valve. Improved engine indicators with compact reducing mechanism, revolution counter, and steam gauge tester. The exhibit was in charge of Thos. R. Freeman, of Chicago, and Mr. W. T. Johnson, of New York.

The Mason Regulator Co., of Boston, Mass., displayed a complete line of steam regulating appliances. This company makes a specialty of locomotive steam regulators. Mr. Wm. B. Mason, president, and Mr. Frank A. Morrison, were in charge of the exhibit.

The Harrison Dust Guard Co., of Toledo, Ohio, had on exhibition the Harrison Dust Guard in four sizes, viz.: 3¾x7 inches for 40,000-pound capacity cars, 4⅛x8 inches for 60,000-pound cars, 5x9 inches for 80,000-pound cars and 5½x10 inches for 100,000-pound cars. Also a

column guide for car truck bolsters, and the Harrison journal lubricator. This is a new device which has received much favorable comment. The exhibit is in charge of Mr. F. B. Harrison, president and general manager, and Mr. L. Y. Williams, mechanical engineer.

The Walworth Manufacturing Co., of Boston, Mass., displayed an attractive assortment of ratchets, Stilson wrenches, stocks and dies, pipe taps, pipe vices, pipe cutters, nippel holders, Mack's locomotive injectors. Smith's railway track ratchet, etc. Messrs. G. E. Pickering and G. F. Elliot were in charge.

The exhibit of the Armstrong Brothers Tool Co., though small in size was full of interest. It comprised a full line of the tool holders designed for the use of inserted cutters of self-hardening tool steel for lathe and plainer work, also a line of improved plainer or levelling jacks, clamp dogs, drill holders, and a number of the well-known Armstrong gang tools for plainer work. The company was represented by Mr. Paul Armstrong.

The Crane Company, of Chicago, had an interesting display of gun metal angle and globe valves and blow-off valves for high steam pressure. The new locomotive muffler pop attracted attention on account of its self-adjusting feature. It is possible to set a valve at 150 lbs. and subsequently raise the pressure up to say 200 lbs. or lower it down to 125 lbs. by turning the very conveniently placed outside regulator, operating the gearing inside the muffler, and so raising or lowering the adjustment ring, as the pressure is increased or decreased. In these adjustments the minimum waste or loss of steam of 3 lbs. is constant under the greatest range of pressures. The unique point about all this is that it can be done while the boiler is under pressure and without taking the valve apart.

One of the most popular souvenirs of the convention was the one, generously given away by the Crane Co. It is a genuine souvenir, as it was made by the company itself and is a clever adaptation of one of its own products to a novel use. Fancy a neat, little, nickel-plated ¼-in. angle valve, mounted on a dark colored malleable tray, and used as a cigar cutter! It positively invites a man to smoke. The souvenir is not more highly finished than the company's ordinary make of valves, because it is one of them up to a certain point. A boss in the center of the ash tray, tunneled through to catch the cigar end, is the base upon which the little valve stands. The angle opening is reamed out, taper, to fit the cigar, and the internal mechanism of the valve consists of a circular cutter which, when sharply pressed down, by a blow on the valve handle, nips off the end of a choice Havana in most approved style. The top of the valve is removable so that the cutter may be sharpened, and we are authorized to state that all parts are strictly interchangeable, between the company and the mechanical fraternity. The curious thing about this useful desk ornament is that those who smoke pipes, enthusiastically claim the valve as a "pipe fitting," while those who use the weed in another form, regard it as more as "fitting a cigar," while the cigarette users who can't have it at all, are green with envy.

This "pipe-fitting," cigar-cutter will be given to any bona-fide railroad official who cares to make application for it, to the Crane Co., Chicago, Ill.

The Joseph Dixon Crucible Company, of Jersey City, N. J., exhibited its graphite paint for iron and steel, the preservative merits of which are widely known. Mr. H. A. Nealley was in charge of the exhibit.

The McCord Co., of Chicago, had on exhibition the McCord journal box with its tightly closing lipped box cover, and the McCord spring dampener, which is briefly, a device, the object of which is to make a coil spring do, as far as possible, the work of an elliptic spring. With this device in operation, a shock, instead of causing the spring to vibrate freely, dampens its motion by the friction of two sleeves sliding upon one another, and so causes it to settle down slowly and come back to rest with only one vibration.

The Handy Car Equipment Company showed the Snow car and locomotive replacers, which are certainly handy tools. The American Dust guard was also on view. Some printed information regarding the Handy Car was distributed, but a model of the Handy Horizontally swinging pilot coupler attracted most attention. The coupler is arranged to swing horizontally, and disappear within a pocket in the pilot. When in this position the outside edge of the coupler presents a face sloping at the same angle as the rest of the pilot. When running forward there is nothing on the pilot to catch or knock down stock or other obstructions on the track, and throw them under the wheels. It is much more "handy" to throw them off clear of the rails altogether.

Mr. H. G. Hammett, of Troy, N. Y., had an exhibit which included the Richardson and Allen-Richardson balanced slide valves. He also showed the "Sansom" air-operated locomotive bell ringer. A link grinder of simple construction and handy manipulation was examined by many interested in railroad shop economies. This tool holds a link, with adjustment for proper curvature of link, and swings it with a pendulum motion upon a rapidly rotating grinder. A link subjected to this process is bound to be ground true.

The Gold Car Heating and Lighting Company, of New York, exhibited several systems of car heating. Conspicuous among these was the system of water circulation which is used with the Pullman steel heater of the Frumveller type. By this device heat can be so regulated as to produce and maintain any desired temperature in a passenger car. The Gold improved plain pipe system, which takes steam direct from the locomotive was shown in full operation. All of the Gold Company's specialties were there, including pressure regulators, automatic steam traps, duplex coils, gravity traps, etc. A line of straight-port steam couplers was also exhibited. These couplings have full 1½-in. openings and provide a square area for the passage of steam, larger than that given by a 1½-in. pipe.

The Economy Car Heating Company, of Portland, Ore., has developed a system or car heating by using the air-pump exhaust steam, instead of live steam from the boiler. A full sized equipment in operation was used to demonstrate the feasibility of the scheme. The idea is to use the exhaust steam to the full for heating purposes, and to supplement it with live steam when necessary, and not call upon the boiler to do it all, all the time. A suitable regulator valve controls the flow of live steam from the boiler.

The American Balance Valve Company, of Jersey Shore, Pa., had a good exhibit of balanced slide valves and piston valves. The J. T. Wilson high pressure valve was open for examination, several sections being used. The point of interest about this valve is that the balanced area of the valve is changeable, the area of balance corresponding with the changed condition of the valve on its seat at different points of its travel. The exhibit also included specimens of the American metallic piston rod and valve stem packing, and the Nixon safety staybolt sleeve. Mr. J. T. Wilson was in charge.

The J. S. Toppan Co., of Chicago, had among its list of exhibits the Martin steam and air specialties. For steam heat and air, between cars a full port flexible metal conduit is provided, also the same between engine and tender. All joints are absolutely guaranteed against leaks. An entire metallic flexible connection has been devised for conveying liquid fuel from tender to burner in oil burning locomotives. This connection always insures an unrestricted opening, and the walls of the conveyor pipe cannot be acted upon by the passing through of the liquid, as is the case where rubber is used.

The Toppan Co. also exhibited a model of the Miller permanent grain door, and

a working model of the Kennicott water softener for railroad use.

The Waycott Supply Co., of St. Louis, Mo., had an exhibit of very substantial Damascus brake beams, made of structural steel I-beams, with web horizontal. Mr. Albert Waycott and Phillip T. Handiges represented the company.

The Chicago Pneumatic Tool Co., of Chicago, Ill., showed a full line of Pneumatic hammers, drills and other pneumatic tools. It is announced that this company has purchased the works of the International Tool Company, of London, whose works are at Chippenham, England. It is said that the acquisition of this plant gives this company practically a monopoly in its line of business in Great Britain and Europe.

The Commonwealth Steel Co., of St. Louis, Mo., had an exhibit with model truck and bolsters. The company will, when its plant is completed about September 12 of this year, be prepared to build Commonwealth trucks, swing trucks, end truck castings, truck swing end castings, truck bolsters, body bolsters, and separable body bolsters. Mr. J. S. Andrews and Mr. C. T. Westlake were in charge of the exhibit.

The Philadelphia Pneumatic Tool Co., of Philadelphia, had a good assortment of chipping, caulking, and riveting hammers, yoke riveters, rotary drills, breast drills, and a complete pneumatic equipment. The large size of the chip cut off by the chipping hammers showed that these tools can certainly do plenty of hard work, and the foundry rammers in action, certainly appeared to "know enough to pound sand." An ingenious arrangement of hexagon and circular tool shank enables one to hold a chipping hammer with chisel horizontal, while a flue caulking tool is free to turn round as required. The claim is made that these tools are economical in the use of air.

The Gould Car Coupler Company, of New York, exhibited its improved malleable draw gear for freight cars, with spring buffer blocks, also its improved M. C. B. coupler which is applicable to 100,000 lbs. capacity freight cars. An improved locomotive and tender coupler intended for heavy equipment was also shown. The Gould passenger and freight car brake slack adjuster was on exhibition, as well as the improved M. C. B. journal boxes, with their bevel joint lids, which are intended to be absolutely dust proof. It is claimed that no jolting or vibration will open the lid or displace it, and so the liability of loosing lids is obviated and no dust can drive in at the edges of the lid, because the sides of the box protect them. Messrs. C. M. Gould, F. P. Hauntley, Geo. H. Widner, W. F. Richards, and Dr. C. W. Gould represented the company.

The Safety Car Heating & Lighting Co., of New York, had an exhibit in its customary corner in the Grand Union office, which was up to the usual standard of attractiveness. It however, proved of especial interest to the railroad representatives in attendance at the convention, owing to the fact that a variety of new styles of lamps were displayed. The new designs are unusually attractive and we understand are proving very popular.

The model of the Safety System of Steam Heat which was shown this year, was a fine piece of workmanship and was perfect in every detail, so the advantages of the system were apparent. It is certain that the Pintsch exhibit was one of the most popular at the convention. The white and gold of the exhibit frame, and the brilliancy of the light, in addition to the soft rugs, easy chairs, and beautiful palms all tended to make that corner of the office a cheerful one and it was crowded at all times, both day and night.

Manning, Maxwell & Moore, of New York, were represented by a very interesting display of steam valves, check valves, strainers for locomotives, and inspirators. Mr. Geo. E. Sevey, Mr. C. E. Randall and Mr. F. P. Smith, represented this well-known firm.

The Chicago Railway Equipment Co., of Chicago, Ill., had an exhibit which prominently displayed the "Diamond Special" passenger brake beam for the high speed brake. This company now handles Monarch solid, the National hollow, the Sterlingworth, the Kewanee, the Diamond Central, and the "Ninety-Six" brake beams. Roller side bearings for all classes of freight and passenger cars and locomotive tenders were shown. A roller bearing with several hundred thousand miles of service behind it, was also on view.

G. S. Wood & Co., of Chicago, was a new railroad supply house which exhibited at the June Saratoga conventions. This firm manufactures a passenger car vestibule diaphragm, of heavy cotton belting, double sewed with waxed thread. It is leather bound inside and out. It is made to suit Pullman, Gould or American Car & Foundry style of vestibule. It is claimed that by its form of construction it prevents sagging at the top, and is very durable. The company whose office is at 100 Lake street, Chicago, also deals in furnishings for dining cars, sleepers, private cars and coaches. Messrs. G. S. Wood, H. H. Schroyer and Stanley Woodworth, compose the new firm.

The Railway Appliances Co., of Chicago, Ill., were represented at the Saratoga June conventions. This concern deals in Ajax canvas vestibule diaphragms, auxiliary couplers, and the Gilman-Brown emergency knuckle. Mr. George H. Sargent represented the company.

The Smillie Coupler and Manufacturing Company, of Newark, N. J., was represented at the convention by Mr. C. H. Taylor, the exhibit consisted chiefly of blue prints and photographs of the company's products.

The Piper Friction Draft Gear Company, Cleveland, Ohio, had an interesting exhibit of its products. In the Piper draw gear the springs are set at right angles to the line of thrust and pull, and their compression is brought about by the movement of two castings, each shaped like a bow-window, these castings are pressed upon by wedge-shaped pieces, which develop enormous friction while compressing the springs under shock. Dr. N. C. Scott represented the company.

The Bath Automatic Universal combination grinder was exhibited by Hill, Clark & Co., of 123 Liberty street, New York. This machine attracted a good deal of attention. It is very convenient to operate on account of the vertical arm movements, which can be varied fast or slow as desired. It has a large range of speeds and gives an opportunity to use large wheels, and large wheels cut faster and keep their size longer than small ones, and thus do more work.

W. W. Converse & Co., of Palmer, Mass., showed samples of the Converse Headlight Cleaner, which is used on many of the leading roads of the country. It is a preparation for cleaning the silvered surface of head light reflectors and is guaranteed to be free from grit, acid or any ingredient which can wear or injure the surface which it cleans.

The Carborundum Company, of Niagara Falls, N. Y., had on view a full line of the goods in which it deals, such as carborundum wheels, paper, cloth, carborundum grains and other specialties. The crude materials out of which carborundum is made are, sand, coke, sawdust and salt. These are heated to an intensely high temperature in a specially constructed electric furnace. At the end of about 36 hours the current is cut off and the now collapsed furnace is allowed to cool. Carborundum crystals are formed during the process, which are broken up or ground into the required sized grits. Carborundum is the nearest to the diamond, in composition of any artificially prepared substance in the world.

The General Electric Company, of Schenectady, N. Y., exhibited an 8 H. P.

motor, conveniently placed, driving a 48-in. portable Newton slotter, and also two large sized Chapman gate valves were opened and closed by the operation of a small motor bolted to the valve spindle frame. The motor was connected by a train of gear wheels to the main wheel used in raising the gate valve. The presence of the motor does not prevent the valve from being opened or closed by hand power when desired.

The Edwards Railroad Electric Light Co., of Cincinnati, Ohio, had a half section of a full sized electric headlight generator and steam turbine, which admirably displayed the construction of the various parts. The small steam turbine wheel is a most interesting piece of mechanism, with its miniature pressed steel buckets, and its remarkably perfect balance. The portion of the headlight case, usually intended to carry off the smoke from the lamp, is ingeniously used to hold the adjustment for the upper carbon. The glass of the headlight, instead of being in one piece, is composed of vertical strips of glass like those of a search light. In case one or more of these strips become broken, the whole headlight glass is not thereby destroyed. The Edwards headlamp throws a vertical beam of light into the night, as well as project 60 per cent. along the track in front of the engine.

The Economy Locomotive Sander Co., of Baltimore, Md., had on exhibition in working order, locomotive sanders, single and double, outside and inside. The company claims to be able to use any grade of sand with both economy of sand and economy of air. The new engineer's single, and engineer's double sander lever valves were shown in operation. A feature of these valves is that on moving the handle slightly, a warning port is uncovered which allows a light escape of air and thus assures the operator that air is actually flowing. A further movement closes the warning port and introduces air into the sand pipe, and carries the requisite amount of sand to the rails.

The Bullock Electric Manufacturing Co., of Cincinnati, Ohio, had among other exhibits, a 28-in. lathe (Lodge & Shipley) in operation driven by a type "N" Bullock electric motor neatly placed at the head of the machine. The speed is controlled by the Bullock multiple voltage system. This system of control is adapted to varying the speeds of direct current motors by supplying the armature with different voltages, while the fields are constantly excited from any one specific voltage. Mr. F. G. Bolles and Mr. Wm. Cooper were in charge.

The American Locomotive Company exhibited a consolidation engine for the D. & H. cylinders 21 x 30, piston valves and drivers 56-ins. diameter, built at the Schenectady shops; another Schenectady consolidation for the D. L. & W. with cylinders 21 x 26-ins., and drivers 57-ins. diameter. A Schenectady tandem compound consolidation for the N. Y. C. & H. R. was also on view. Cylinders 15 and 28 x 36-ins., driving wheel diameter 63-ins. A Brooks Atlantic type passenger engine was also shown, built for the C. Rd. of N. J., cylinders 21 x 26-ins., and drivers 57 ins. in diameter.

J. S. Thompson, of the American Brake Shoe & F'd'y Co., exhibted a pass issued by the Penna. R. R. Co. to his father, Mr. J. Thompson, who was a member of the M. M. Association at the convention at Pittsburg in 1869. This pass is more interesting owing to the fact that it was on this train that Mr. Geo. Westinghouse first demonstrated that a train could be stopped by air.

The American Brake Shoe and Foundry Co., of New York, had on view an assortment of the various brake shoes made under the patents of the American Brake Shoe Co., the Ramapo Foundry Co., the Sargent Co., the Lappin Brake Shoe Co., the Streeter Brake Shoe Co., the Corning Brake Shoe and Iron Works and the Ross-Mechan Foundry Co. The shoes made are the Diamond "S," the Sargent, the Lappin, the Corning, the Streeter, the Heron, and the Cardwell. One of the interesting features of this interesting collection was the reinforced back which is applicable to shoes used in connection with the high speed brake.

Cast iron, the ideal metal for the brake shoe from the frictional standpoint is too weak to stand the excessive requirement of modern railway service—loads and speeds have increased until the work demanded of the brake shoe is beyond the endurance of cast iron.

A steel back, applicable to all shoes, has been introduced, to give the shoe strength sufficient to prevent fracture and permits it to be worn out completely. The endeavor of the company has been to provide shoes which will have maximum retarding power consistent with the ability to stay at work until worn out. Tire dressing shoes are made to suit heavy or light tire wear, due to rail pressure. They are made with steel inserts, and have wrought iron or steel hooks which cannot pull out and do not fracture. All varieties of brake service are appropriately met by some specially designed shoe. The company also makes oil cups of the Tropenas steel which are more durable than brass, and less expensive. A variety of cast steel wrenches for locomotive and car work were shown. They are tempered in oil, and are of all sizes.

The Waterbury Tool Company, of Waterbury, Conn., exhibited the Williams Universal Ratchet. This handy little tool has surprising ability for drilling holes in close places, where, for lack of room, it is most difficult to use a tool. Mr. H. G. Hoadley was in charge.

T. H. Symington & Co., of Baltimore, Md., were among the convention exhibitors, with railway journal boxes and dust guards. Mr. Symington and Mr. W. R. Bean were present.

The Standard Paint Company, of New York, in addition to its "color scheme" had several models of refrigerator cars, showing insulation. Samples of insulating paper and sheeting, iron and wood preservative paint and car flooring and roofing were shown. Messrs. J. C. Shainwald, Chas. Earnshaw and J. N. Richards looked after the company's interests.

The John N. Poage Manufacturing Co., of Chincinnati, Ohio, had a very complete exhibit of the Williams grain door. Mr. Paul Fenner, Jr., and M. E. F. Luce, explained the construction and operation of the door, to those seeking information.

The New Jersey Car Spring and Rubber Co., Jersey City, N. J., displayed a full assortment of railway hose and rubber packing. Mr. R. H. Boaz in charge.

The National Railway Specialty Co., of Chicago, exhibited the Durham car door, Security car door, the N. R. S. hose clamp and the National adjustable journal bearing. Mr. P. M. Elliot was in charge.

The National Malleable Castings Co., of Cleveland, Ohio, had as its "*piece de resistance*" the Tower coupler. The representatives on the ground were Messrs. Davidson, Call, Whitlock, Angle and Coffin.

The Nathan Manufacturing Co., of New York, had on view a full line of its various sight feed lubricators and injectors, with which the railway public is so familiar. The company was represented by Messrs. W. Tooth, Minor, Currie, E. Tooth and G. Royal, Jr.

The Keystone Drop Forge Works, of Philadelphia, Pa., exhibited samples of drop forge work such as the Keystone connecting links, safety shackle hooks, and the Keystone crocodile wrench. Boiler stays and other special drop forgings were shown. The use of drop forgings as part of the staying system in boilers is growing in favor. Mr. A. Morris Hall took charge of the exhibit.

The Jenkins Brothers, of New York, Chicago, Philadelphia, Boston and London, had a full line of the various sizes and shapes of the well-known Jenkins valves, and valve packing. Mr. J. H. William, A. A. Langston and Chas. W. Martin, Jr., represented the firm.

The Davis Pressed Steel Co., of Wilmington, Del., had a solid truss rod brake beam. One in which the truss rod is included in the rolled section, and is cut off, in a shears, within four inches from the end of the rolled bar. The bar having the truss rod cut from it, is upset three inches, so that, although the body of the brake beam is compressed, the truss rod is bowed out sufficiently to receive a strut between beam and rod. There are few parts to get out of order, and none which can be lost. Altogether, the beam is a very ingeniously designed one.

Mr. S. A. Crone, of New York, had an exhibit of the railway specialties which he handles, among which may be mentioned his well-known spiral nut-lock and rocker side bearing. Mr. Crone was in charge of his own exhibit.

The Buffalo Forge Co., Buffalo, N. Y., displayed fans for induced draft for boiler furnaces, also down draft forges, blowers and exhausters for use in railway and other shops. The representatives were Mr. E. T. Lyle and Mr. W. H. Carrier.

The Brady Brass Co., of New York, had an exhibit of Cyprus bronze for locomotive and journal bearings. Cyprus bronze ingots, and some samples of locomotive castings after having been machined. Messrs. D. M. Brady, C. M. Rubens and F. C. Cameron were the company's representatives on the ground.

The Boston Belting Co., of Boston, Mass., had on exhibition various samples of the steam and water hose which it makes. Mr. Geo. H. Forsythe, assistant manager, with Messrs. F. T. Alden, G. S. Wood and J. F. Muldoon, represented the company.

The Westinghouse Air Brake Company, of Pittsburg, Pa., it is needless to say, had a suitable and comprehensive exhibit. Among other things was a triple valve testing rack and a pair of model cars fitted with Westinghouse brakes, friction draw gear hose couplings and all the appliances for cars handled by this concern. The company was represented by Messrs. Blackall, Kidder, Nellis and Hutchins.

The Metal Plated Car and Lumber Company, of New York, exhibited a section of a passenger car in which each piece of wood used in construction had been covered with oxidized sheet copper. The copper fits skin tight over the wood, and gives a highly finished smooth surface, which is absolutely water tight, and weather proof. Mr. Garrett Burgert represented the company.

The Rand Drill Company, of New York, had on exhibition four kinds of air compressors. The largest was one of the company's Imperial type, capacity 360 cb. ft. of free air per minute. An 8 x 8-in. compressor belt driven of 165 cb. ft. per minute capacity, and two 6 x 6-in. compressors, one electrically driven and one driven by a gasoline engine. Messrs. Traver, Castle and Mackie represented the company.

The exhibit of the J. A. Fay & Egan Co., of Cincinnati, was chiefly composed of photographs of the various wood working machinery made by this firm. In a neatly framed receptacle, were arranged some three hundred gold, silver and bronze medals received by the company as a recognition of the excellence of their product in numerous exhibitions. One valuable medal received by the company was from the exhibition held in the Crystal Palace in London in 1851.

The Standard Coupler Co. showed two types of the Sessions-Standard friction draw gear, called respectively "A" and "C." The C type is adaptable to steel and wood underframing, and for both narrow and wide spacing of draw timbers. A small model was used to demonstrate the action of the gear and to show its ability to absorb shocks. The draw gear consists of coil springs, three wedge pieces and a case. Mr. G. A. Post, president, and Mr. H. H. Sessions, vice-president, were both on the ground.

The Railway Materials Company, of Chicago, exhibited the Ferguson flue welding furnace, the fuel for which is oil. The claim made for this furnace is briefly that the complete combustion it gives, insures that there are no unburned particles of carbon left on the scarfs to prevent cohesion.

The McConway & Torley Company, of Pittsburg, Pa., had on exhibition four styles of couplers. They were the Janney coupler (reinforced), the Kelso for locomotive pilot, the Kelso all steel, and the Kelso malleable iron couplers. The reinforcement feature, which was exemplified in all these couplers, is intended to lessen the number of pin breakages. The back of the knuckle is made with a hook which engages with the coupler head back of the pin. In pulling, this device relieves the pin of a good deal of strain, and so reduces its wear and the liability to failure.

The Bethlehem Steel Company, Bethlehem, Pa., was among the new exhibitors at Saratoga. Beside a handsome series of mounted photographs showing views of the well equipped shops of the company and some of the finish-machined forgings for which it is noted, there was displayed a full-sized hollow nickel-steel lomotive piston-rod cut longitudinally, and a similar rod bent cold to show the toughness of the Bethlehem nickel-steel. Solid and hollow crank or wrist pins, and a hollow locomotive driving axle, were also on exhibition.

To show the advantages obtained by the use of nickel steel in locomotive construction the company displayed a very interesting set of mounted tensile tests and bending bars. Each series of mounted test-specimens was accompanied by photo-micrographs showing the uniform fine crystalline structure obtained with nickel-steel after receiving its proper heat treatment.

The Baltimore Ball Bearing Co., of Baltimore, Md., had an exhibit of the Norwood ball-bearing center plate and side bearings. Mr. J. E. Norwood, the superintendent of the company was present to explain the action of his various devices. The balls in all these bearings are made of tool steel and are so hard as to be practically indestructible. One feature which always attracts attention, is that the balls are suspended in the upper bearing and cannot possibly clog. If desired, an effective dust guard may be provided, as shown in one design exhibited for the center plate, by which it is impossible for dust or grit to get to the ball race. It is claimed that a truck with these bearings, slewed by a curve, on encountering a tangent will easily right itself, and so reduce flange wear.

The Wheel Truing Brake Shoe Company, of Detroit, Mich., had on exhibition a sample of its wheel truing brake shoes for cars, coaches and locomotive driving wheels. Dr. Griffin, who was in charge, tells of an amusing experience he had with a railroad company which, after a month's trial of these wheel truing shoes, complained that neither shoes nor tires were left. These shoes are only intended to be kept in serivce long enough to do the work for which they are intended, viz.: truing up flat wheels.

The Auto Coupler reappeared among the exhibits at the M. C. B. convention this year, with certain improvements. This coupler, while of the vertical plane type, has one or two attributes which are peculiarly its own. It consists essentially of three parts—the shank, the head and the knuckle. The shank and head are joined together by a substantial pin, which allows the head to swing a certain distance to each side. That secures flexibility. The knuckle is pivoted about this same pin, and the projecting portion, which engages with another knuckle, moves to and fro in the usual way, but without exposing or hiding, a shank which in regular practice is held or released by the locking pin.

The sum total of the arrangement of parts is that the coupler somewhat resembles a human right hand, the wrist acting as the pivot point, with the thumb as guard arm. The index and little fingers, being held rigidly in position, the two center fingers, with additional motion, roughly resemble the knuckle.

In practice one auto coupler will couple with another auto coupler with both knuckles open, or with one shut. It will go a step further, and two autos will couple together with both knuckles closed. This latter performance is good, no doubt, but the auto has no foolish preference for couplers of its own name. It will couple with any other M. C. B. coupler, with its own and the opposing knuckle shut. The auto makes light of knuckle position. It does not waste time thinking about how a knuckle stands. It has the knuckle "in its head" all the time. The auto says in effect, "Don't prepare things for me, let me go up against any M. C. B. coupler and I will hook it every time." In thus boldly speaking out its mind that position is not everything, the auto regards itself as simply true to its name.

In switching, if you kick a car with an auto into a long siding full of cars, and want to draw it out subsequently, you will have to go to it and uncouple it personally, because it will infallibly have "caught on" to whatever was there, no matter how much trouble this entails upon you. But the auto has its kindly and genial side, even when attending strictly to business. You can take a car with an auto coupler at the end of a string of cars handled by an engine, and push it down a siding to get a lone car at the far away end, and you won't have to go with it, for the auto will ask no questions, but will hook that car securely and you can draw it out, as an angler draws a lusty trout out of some cool, still pool. It does this, as the auto, ought to.

Stevens' Automatic Stoker.

The annexed engravings reproduce photographs of an automatic stoker which has been tried on the Southern Pacific system. It is the invention of Mr. Fred A. Stevens, a son of the late A. J. Stevens, who was for years superintendent of motive power of the Southern Pacific, and was inventor of a well-known valve motion. Mr. Stevens has designed his stoker to be a coal conveyor, or a coal crusher and a stoker. Describing his invention, Mr. Stevens writes.

"My invention relates to a device which is designed to mechanically supply and prepare coal or other similar solid fuel for use in boiler or other furnaces and to deliver it therein, in a steady, uniform manner. This mechanical stoker will handle the usual size coals as commercially used, crushing them to the desired size, as circumstances may require. Directly in front of the door is a vertically journaled hopper, into which the fuel is first delivered, as follows: An elevator or conveyor extending to the fuel pile and having within it either an endless traveling belt with buckets driven by chain and sprockets, or it may be provided with any other well-known conveying device. The lower end of the conveyor is so shaped that the fuel can be delivered to the carrying devices and they will carry it up and will deliver it into the crusher above the hopper.

"The crusher is provided with rollers, between which the fuel must pass, so as to be crushed or broken to any desired size. These rolls are arranged so that coarse or fine coal can be had instantly by enlarging or diminishing the space between the rolls, which can be done while the machine is in motion.

"The roller shafts have pinions fixed to them, which engage with and are driven by a worm or screw upon the main shaft. The upper end of the conveyor is so constructed as to form a delivery chute for the fuel which is brought up by it.

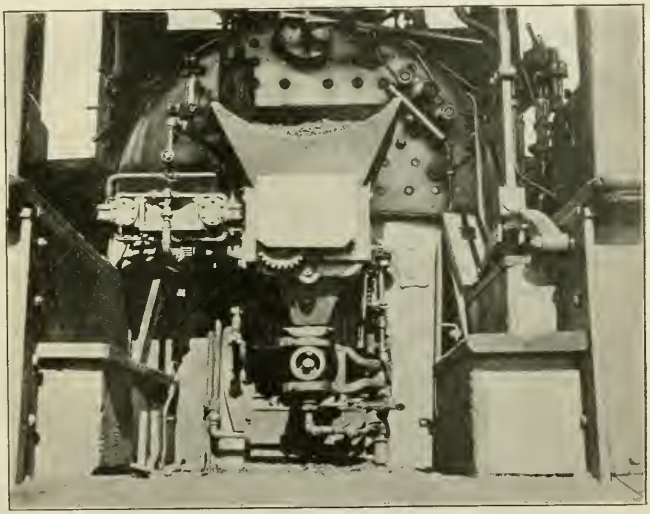
"The conveyor sprocket is driven from the horizontal shaft, journaled across the boiler front, and connected with a motor with intermediate gearing, to regulate the movement of the conveyor, the speed of motor to be regulated either by hand or automatically by the steam pressure of boiler as may be desired.

Below the hopper, into which the coal is delivered from the crusher, is an injector, which in the present case is shown of globular form, having a tube extending from it directly into the lower part of the door opening.

"The rear end of the chamber is open for the admission of air, and centrally within it is fixed an injector, through which compressed air or steam may be delivered by means of a pipe, with a swivel-joint connection to the interior of the chamber.

"The prepared coal falling down through the hopper into the chamber or injector is caught by the blast thus produced and driven into the furnace through the tube. This is an essential feature of the device. In order to properly distribute this coal from side to side, a hopper, delivery pipe or injector, turnable in vertical supports or journals, are used and arranged so that the injector nozzle may be made to swing from side to side of the door opening. This is effected by means of a link, connecting the injector with a crank pin, at the bottom of a vertical shaft, to which a rotary motion is imparted, so that as the shaft is rotated the discharge pipe is caused to swing from side to side of the door opening, thus delivering the fuel from one side to the other of the furnace, imitating hand firing.

"In order to distribute it evenly from front to rear, a deflector, attached to a horizontal shaft, the shaft being journaled or supported in front of the door opening, so that the deflector plate projects into the furnace, and when the plate is turned downward it intercepts the discharge of the fuel from the injector pipe, and deflects it down into that portion of the furnace nearest the door, the injector pipe distributing it at the same time from side to side.



STEVENS' AUTOMATIC STOKER.

"When the deflector plate is raised, it allows the discharge from the pipe to pass toward the opposite end of the furnace.

"The vertical motion of the deflector is constant and works in connection with the horizontal motion of the pipe, or injector. The deflector plate is arranged so that it can be operated so as to deposit a greater amount of fuel in either end of the furnace, or to deposit the fuel evenly over the entire grate surface."

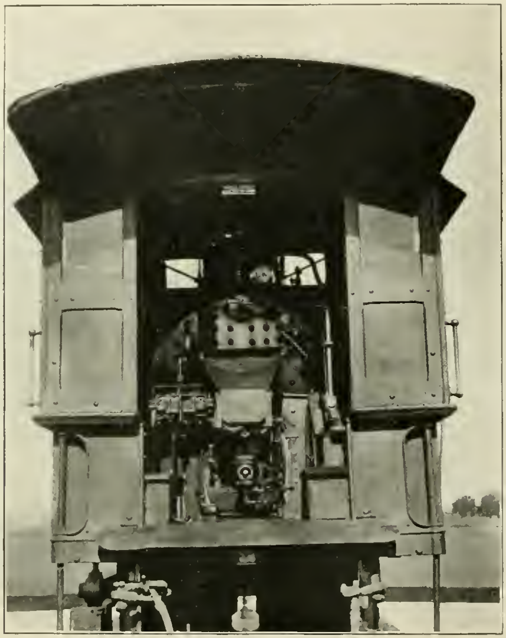
Motor Driven Air Compressors.

We have just received the catalogue of the Christensen Engineering Company of Milwaukee, Wis., dealing with motor-driven air compressors. It is well illustrated with half tones and full descriptions of the various types of compressors made by this company are given, with sizes and capacity of each. Among the claims made is that nearly all the working parts operate in a bath of oil, and the other parts are continuously lubricated in a very thorough manner. An item worthy of notice which affects the economy of the machine is that the compressor operates only when air is being used. The automatic governor, supplied with each machine, stops the motor as soon as the pressure reaches a predetermined maximum, and starts it again when the pressure is reduced to a minimum.

Copies of this catalogue may be had by persons interested on application. The company's New York office is at 135 Broadway.

Farming Preferable to Railroading.

Some of the most successful men in railway life have spent their early youth on farms. The training of hard work received on farms has been valuable in developing the quiet perseverance and the uncomplaining endurance that do so much to insure the success of men in railway work; but the prizes gained by farm-raised boys are small in proportion to the number who have tried to gain them. There is a constant influx of farmer boys into railway service, and many of them who succeed in finding employment make the mistake of their lives in leaving farms. Many of them while pursuing the monotonous labors in the fields watch the trains passing to and fro and imagine that the people manning the trains must have a delightful time, with little to do, following an eventful existence where fatigue and weariness are unknown. There is little time for weariness among trainmen, but there is daily hard work of a character so trying, so wearing and so exacting that the farm youth never did work to approach it. Seldom a week passes when we fail to receive letters from farm hands, many of them sons of substantial farmers, asking us to advise them how to proceed so that an appointment as fireman can be secured. A farmer is about the most independent man in the community, and improved machinery has done much to lighten his labors. To the youth who is striving to escape from that occupation we have one answer—don't.



STEVENS' AUTOMATIC STOKER.

The Q. & C. Company have resumed active business at the old stand in Chicago with our energetic old friend, Mr. C. F. Quincy, holding the throttle. His presence as the active manager insure activity, energy and the pushing of modern business methods.

One Locomotive to Every 10,000 Inhabitants of This Earth.

At the close of the nineteenth century there were between 130,000 and 140,000 steam locomotives in operation upon the railways of the world, according to an estimate made by M. Edouard Sauvage in a paper read before the Société d'Encouragement de l'Industrie Nationale. This estimate gives about one locomotive for every 10,000 inhabitants of the earth, and the total value of the engines is probably between $800,000,000 and $1,000,000,000. About half a million men are employed, operating, tending and repairing these machines.

In Great Britain freight trains of moderate weight are hauled at fair speeds. On the Continent slow heavy trains are the rule, while in the United States very heavy trains drawn by colossal locomotives with eight coupled wheels are found. The axle load of these engines being from 18 to 22 tons.

M. Sauvage points to the deep impress which the work of the engineer has made upon the civilization and industry of the world.

Very curious facts appear to have been developed concerning the influence of grease in boilers. He says that there is no doubt that the introduction of grease will cause furnaces to bulge and tubes to burst, but at the same time an examination of the injured parts shows grease to be absent from them, although present in other parts of the boiler. It may be, he says, that grease undergoes a chemical change which renders it a far worse conductor of heat than it was. The action of grease in boilers is fully established, though no one has so far come forward with an adequate explanation.

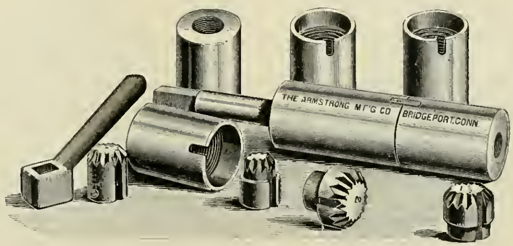
Fellow Servant Law of North Carolina.

The State of North Carolina has an ideal law which was passed as a substitute for so-called Fellow Servants Law which has done so much injustice to unfortunate railroad men. The North Carolina law was enacted greatly through the efforts of Mr. B. R. Lacy, an old locomotive engineer, who is now State Treasurer. The law reads:

Section 1. That any servant or employee of any railroad company operating in this State, who shall suffer injury to his person, or the personal representative of any such servant or employee who shall have suffered death in the course of his services or employment with said company by the negligence, carelessness or incompetency of any other servant, employee or agent of the company, or by any defect in the machinery, ways or appliances of the company, shall be entitled to maintain an action against such company.

Section 2. That any contract or agreement, expressed or implied, made by any employee of said company to waive the benefit of the aforesaid section shall be null and void.

Section 3. That this act shall be in force from and after its ratification.



ARMSTRONG MFG. CO.'S NIPPLE HOLDER.

A new nipple holder has been made by the Armstrong Mfg. Co., of Bridgeport, Conn., to be used in connection with their No. 00 pipe threading machine. It holds pipe from 1 to 4 inches inclusive by using different threaded rings and backing pieces. It will also hold close nipples either right hand or left hand, no change of parts being necessary to hold the nipple for threading it left hand. When thread is cut the nipple can be removed with the fingers by loosening the screw in the back of the holder. This nipple holder can be furnished to hold as small as ¾-inch if required.

Grease in Boilers.

Some interesting computations were given by Mr. Stromeyer in a paper read before the British Institute of Naval Architects, showing the very short time required for metal to become overheated under conditions which may occur in steam boilers. He emphasizes the important matter of the reduction of strength which takes place under even moderate overheating.

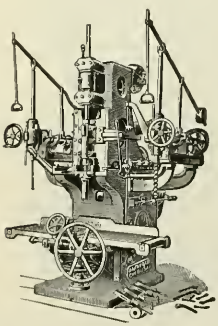
"Firing Locomotives" is the name of a new book by Angus Sinclair, recently published by this office. It is a very readable elementary treatise on combustion, suitable for the pocket. It contains as much real information as many big books. Price, 50 cents.

International Cable Directory.

We have received from the International Cable Directory Company, 17 State street, a copy of the International Cable Directory of the World, issued in conjunction with the Western Union telegraphic code system. This book, to users of the wires, both for domestic or cabling purposes, is to the business public exactly what the telephone book is to users of the telephone, as it furnishes the cable addresses of prominent corporations, firms and individuals in all parts of the globe, and is therefore invaluable for reference. The Directory contains the only classified list of American manufacturers extant.

No. 4 Vertical Hollow Chisel Car Mortiser.

One of the most powerful machines for mortising, especially in car shops, is herewith represented. Much care has been exercised to make it strong, simple in construction, and powerful in operation, doing away with the necessity of laying out the work or cleaning the mortises.



HOLLOW CHISEL MORTISING MACHINE.

The chisel ram carries the boring spindle that prepares the work for the chisel, there being stops to regulate its vertical and lateral travel. The vertical movement is 16 inches, the extreme lateral motion, 14 inches. The reciprocating motion is produced by reversing the friction and gearing. The table is 4½ feet long, and has stops to regulate the length of the mortise. It is easily operated, and has an adjustable clamp for firmly holding the work.

A boring attachment is at each end of the frame, at a distance enabling them of being adjusted to an angle of 30 inches in either direction. They are especially convenient for joint-bolt boring, and save much handling of material and much valuable time. They have vertical adjustment of 20 inches, and lateral adjustment of 12 inches.

This machine is made by the J. A. Fay & Eagan Co., No. 445 West Front street, Cincinnati, Ohio.

Two rotary converters of 300 K. W. each, have recently been purchased by the Manchester, N. H., Traction Light & Power Company from the Westinghouse Electric & Mfg. Co. They will be located at Hookset, N. H., and will deliver power for the operation of the Concord and Manchester branch of the Boston & Maine Railroad, this road having entered into a contract for power with the Manchester Traction, Light & Power Co. The machines are to be supplied with three-phase alternating current and will deliver direct current at 600 volts.

The annual statement just issued by the Safety Car Heating & Lighting Co., showing the number of Pintsch lighting equipments supplied to the railroad companies of the world, during the past year, as well as furnishing the total number of cars which are equipped with that system throughout the world, brings to mind the general subject of car lighting, and by referring to earlier statements issued by the Pintsch Co., we find that in the period already specified, 8,800 additional Pintsch equipments have been supplied to the Railroads in Germany, and 8,300 to the railroads in the United States. These have been satisfactory, or what might be called normal increases in the Pintsch business in England, France and Austria, but the greatest increase has been in this country and Germany.

Grinder for Piston Rods, Etc.

The Morton Grinding Co., of Worcester, Mass., has brought out a machine for regrinding piston rods, crank pins, valve stems, etc. The machine is arranged with suitable gap which can be placed at any point required, and of any depth, up to 24 inches. It can be used to grind piston rods with pistons in place. The gap enables the machine to swing 29 inches in the clear, and the grinding wheel and its cover are so arranged that a rod can be ground very close up to the piston. The builders are prepared to suit customers as to the size of gap and table. They say that the machine will regrind a piston rod in from 15 to 30 minutes, according to the condition the rod may be in, which is very much quicker than could be done on a lathe. The claim is made that as grinding removes less material than is usually taken off in a lathe, the life of the rod is prolonged if trued up by grinding, and also that a reground rod is not so hard on rod packing as one which has been been turned up in a lathe. The advantages are, briefly, work done in less time, and so done as to insure longer life to the part thus treated.

We have just published a new edition of "Book of Books." If you are looking for books relating to railway business send for the book named.

Cotter Tank Valve.

The tank valve here illustrated is said to possess the following advantages over the old-style four-wing valve:

1st. It has its advantages as a time of labor saved.

2d. It will give perfect service in all kinds of weather.

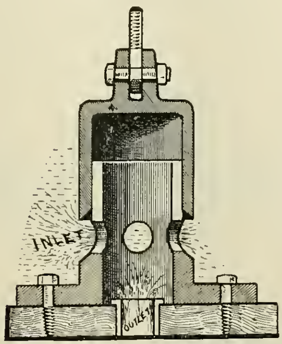
3d. Its seat is on an angle so as to protect it from any obstruction, having an angle of 45 degrees, and nothing can remain on its seat.

4th. No hanging of tank valve; no leakage when off.

5th. It is simple and durable in service, and will give greater satisfaction than any up-to-date improvement of the old-style four-wing valve.

6th. The valve can be placed on the new goose necks with very little expense to the railroad companies.

7th. No changes to be made in the fittings now in use on locomotives. This



COTTER'S TENDER VALVE.

valve is to be placed on the inside of tank. Can be procured from Frank P. Cotter, 1027 Ellis street, Augusta, Ga.

The Smooth-On Manufacturing Company, of Jersey City, has moved into new quarters. The offices are now at 547 and 549 Communipaw avenue and the works are at 53 and 55 Harrison avenue. In its new laboratories the company has the best apparatus for general chemical analysis. A new treatise on the subject has just been issued by the company. It shows deep knowledge, and the style is plain and simple. Another book describes the Smooth-On iron compounds, Smooth-On paint and Smooth-On cements for iron, steel and brass. Both these publications are free for the asking.

At the Hudson Valley Railway Company's power station in Saratoga, there is to be installed a 400 horse power engine and 250 kilowatts, 2,200-volt, belted, alternating current generator with raising transformers. From this power station power will be transmitted by a three-phase, 11,000-volt transmission line to a sub-station at Round Lake, where lowering transformers and a 250 kilowatt rotary converter operating A. C. to D. C. are to be installed. This sub-station will supply power to the recently completed Saratoga Division of the system connecting the main line at Mechanicville with the Saratoga-Balston line at Balston Spa. After the alternating current generating plant is installed next year on the Hudson river, the generating and sub-station apparatus now in use and in course of installation will be displaced by 8,300 kilowatts, 600-volt, D. C. rotary converters. All of the electrical apparatus for the temporary installations and also for the permanent equipment of sub-stations is to be built and furnished by the Westinghouse Electric & Manufacturing Company.

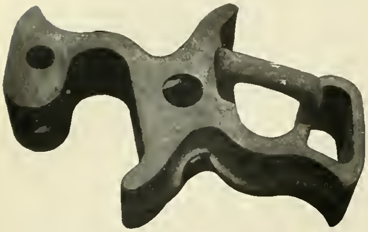
A fleetfooted, fiery Arab steed makes a splendid and alluring form of locomotion in certain Oriental countries, and we are not surprised to learn that any of the latest rival mechanical methods of locomotion have many prejudices to overcome. Mr. John Tyler, American Vice-Consul-General at Teheran, reports that bicycles have reached Persia and had a few admirers, but have made a very homely looking rival to the fine horses for which that country is famous. He says, however, that the bicycle is making its way slowly into favor, and expects that among certain classes it will soon displace the more expensive horse. He says that American machines are the favorites, and he thinks that a good trade in American bicycles can be worked up if someone had the enterprise to keep a stock on hand.

During a visit which Mr. H. H. Westinghouse made to Mexico some time ago he was riding in a private car attached to a train which ran into an open switch causing a bad wreck. The car which Mr. Westinghouse was in had on his company's friction buffer and it absorbed the shock so effectually that the occupants were not aware that a wreck had happened until they were informed by the train men.

The advocates of the Ship Subsidy Bill wax eloquent in Congress about the benefits that would accrue to the American people if the ocean liners and other seagoing craft were under the Stars and Stripes. There are several great steamers belonging to the American Line which are British built and fly the American flag by a special act of Congress. These ships are manned almost exclusively by foreigners, who keep their families in Liverpool, and they spend no more of their earnings in America than do the employees of the British, German, French and Dutch lines.

Auxiliary Coupling.

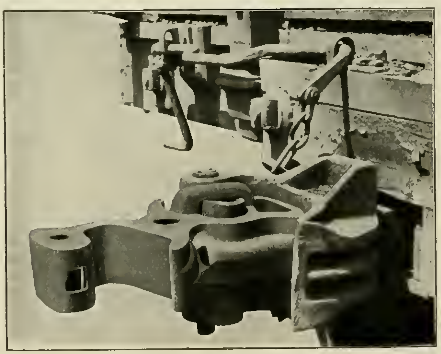
The annexed engravings illustrate an auxiliary coupling put upon the market by the Railway Appliance Co., Chicago, which permits the M. C. B. coupler to be coupled on the shortest of curves, and fills a want which has been badly felt all over the country. This is a device which is exciting a great deal of interest among railroad men due not only to the approach-



GILMAN-BROWN EMERGENCY KNUCKLE.

ing abolition of the link slot and pin hole but also the investigation which has been carried along for some time by the Interstate Commerce Commission regarding the methods used by railroad companies for handling cars on sharp curves. Two of the largest switching roads in Chicago are using this device and it is in test on many others, its great advantage being that it is automatic and does not require the presence of a switchman between the cars.

The Philadelphia Pneumatic Tool Co. is now entirely settled in its new shops



EMERGENCY KNUCKLE IN USE.

at Twenty-first street and Allegheny avenue, Philadelphia. Considerable loss of time naturally resulted from moving, and the company reports being somewhat behind in making shipments. The works are being run night and day, however, to catch up, and orders will be filled with usual promptness at no distant date. A great deal of attention is being attracted to the Keller Pneumatic Hammers, made by the Philadelphia company, by reason of a recently devised improvement in their construction. On account of this improvement the working capacity of the Chipping and Riveting Hammers is increased at least 25 per cent. and the vibration, inseparable from any pneumatic tool, is reduced very materially. This applies to both Chipping and Riveting hammers. Recent large orders have been received from the Southern Pacific Co., Newport News Ship Building & Dry Dock Co., Pennsylvania Railroad Co., Lackawanna Steel Co. and others.

The World's Waste of Coal.

The yearly output of the world's coal mines is estimated by Prof. John Perry in a letter to *Nature* at between six or seven hundred millions of tons yearly. The best and largest steam engines to-day utilize less than 10-per cent. of the energy liberated in the burning of the coal, and smaller engines utilize perhaps about 1 per cent. These figures serve to show the enormous waste of fuel which is going on all the time. The consumption of coal is steadily increasing the world over, and the heat losses stand as stated. Professor Perry suggests that a few millions of dollars should be placed at the disposal of some prominent scientific men for the purpose of enabling them to experimentally study the problem of improving the steam engine, or of finding some substitute for it, so that practically all the energy stored in the coal might be used, and the waste reduced to a minimum, Lord Kelvin and Lord Rayleigh are the two men Professor Perry had in mind in making the suggestion.

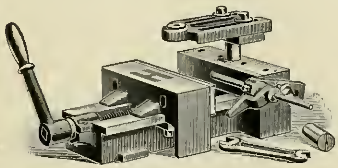
The F. M. Hicks Equipment Locomotive and Car Works seem to be very busy with the repairs of old rolling stock and the building of new, for various railroads. The company make a specialty of repairing of locomotives and cars and have good facilities for doing the work.

The Allis-Chalmers Co.

"It is only when the whole product is appropriate to the purpose intended that it is entitled to be termed the best." This interesting definition of the word best is given by the Allis-Chalmers Co., and that concern has expressed a desire to live up to its own standard. This company, it may be remembered, has absorbed the E. P. Allis Co., of Milwaukee; Fraser & Chalmers, Chicago; the Gates Iron Works, of Chicago, and the Dickson Mfg. Co., of Scranton, Pa. The Allis-Chalmers Co. make air compressors, equip power plants and manufacture mining, smelting and many other kinds of machinery. The general offices are in the Home Insurance Building, Chicago.

A Handy Drill Jig.

This little tool will save its cost many times over in almost any shop having a drill press and very few have not. Used as a vise without the jig attachments it clamps work firmly and quickly and is a great saver of time. The vise has a rigid



GRAHAM JIG VISE.

substantial base and does not tilt under the drill as is apt to be the case when angle plates are used. The work is simply clasped in the vise and slid under the drill—saving time over the usual method of swinging the table or arm.

The drilling jig is attached to stationary jaw of the vise and the work is simply put in place and the drill is accurately located every time. For a small tool it has about as many possibilities in the way of saving time and labor as any known of. It is made by the Graham Mfg. Co., of Providence, R. I.

Suggestions for Broken Cylinder Head.

It is pretty well known by all engineers who take the trouble to find out the workings of the Vanclain compound locomotive, that in case a high pressure piston rod should break that engine could continue to pull her full train even if the cylinder head is broken. That is if we can arrange to plug the hole in the back end of cylinder and find a head of some kind for the front end of the cylinder.

I have seen it suggested in print in some of the journals, that we should carry an extra head on the engine for this purpose. But as this breakdown does not happen very often, I think if we carried an extra head, when we wanted it we could not find it. It would be like the clamps for locking the valve stems. They are very scarce when they are wanted. I have been thinking it would be a good plan to make a cylinder head of the number plate on the front end of the smoke arch for the high pressure cylinder when the engine is built, as we can run without the head on the low pressure cylinder. We only feel the loss of the steam as blast for the fire, and the power of course. But we can keep the train going by high pressure on the broken-down side and put the blower on to make up for the loss of exhaust.

But getting back to the extra head for the high pressure cylinder, if it was made for a head, holes drilled in it and fitted to the cylinder so there would be no mistake about it going on in a hurry, and have a boss cast on it in the middle and have it tapped out so it would screw onto a stud heavy enough to hold it, then it could be ornamented so it would look well. As the most of number plates are about 18 inches diameter and the high pressure cylinders are somewhere about that size, I think this would work all right, and we would always know just where to look for a cylinder head.

To those who have not given this subject a thought, I would say take out piston rod, plug from the front end of cylinder, put on your cylinder head and you are ready to go. As the valve opens to admit steam to the H. P. cylinder, the steam will run through the H. P. cylinder and enter the tubular part and go right to the front of the low pressure cylinder and will work that way alternately at both ends.

A. J. O'Hara.

A Wave Motor.

A novel and ingenious method of raising water has been in successful operation in Santa Cruz, Cal., for some time past. On a cliff on the sea coast two wells have been sunk in the rock, one eight feet in diameter and the other five feet. The wells extend thirty feet above high tide something below ebb tide. The bottoms of these wells are connected with the sea by a horizontal tunnel. In one of the wells is a counterbalanced float, which rises and falls with the action of the waves. In the other well a long force pump, the plunger of which is actuated by the rising and falling float. In this way water is pumped to a height of 125 feet above sea level.

The Armstrong Bros. Tool Company, of Chicago, had the misfortune to go through a fire lately, which put it to great inconvenience, but the plant is now completely re-equipped and is in a better position to turn out work more rapidly than ever. The company has largely increased the shop force and has 30,000 square feet of floor space. Their exhibits at the late conventions attracted much attention.

Rapid Growth of the Pintsch Light System.

An interesting statement has been issued by the Safety Car Heating & Lighting Co. showing the remarkable increase in the use of the Pintsch Light System during the past twelve months, as well as giving the total number of cars, locomotives, buoys and beacons equipped with this system throughout the world. Upon reference to the table, we find that there are at present in the United States and Canada 18,653 cars equipped with the Pintsch System of Lighting, while in the territory controlled by the American Company there are sixty-six Pintsch gas manufacturing plants in operation. The complete statement appears below:

CARS, LOCOMOTIVES, BUOYS, &c., USING PINTSCH SYSTEM OF LIGHTING, TO MAY, 1902.

	Cars.	Locomotives.	Gas Works.	Buoys and Beacons
Germany	40,156	4,786	71	124
Denmark	45		3	21
England	18,859	18	87	272
France	6,741		27	240
Holland	3,487	5	10	86
Italy	1,528		5	15
Switzerland	360	2	1	
Austria	4,218		10	1
Russia	3,041	112	13	13
Sweden	679	43	4	2
Servia	216			
Bulgaria	98		1	
Turkey	114			
Egypt	42		3	118
Canada	166		3	65
Brazil	974	31	1	33
Argentine	1,096		10	2
Chili	46		2	
India	9,584		16	
Australia	2,053		13	38
United States	18,497		63	172
Japan	100		2	4
China			1	15
Mexico	81		1	
Total	112,191	4,997	347	1,211
Increase for the year	6,527	525	11	49

Accident Bulletin No. 2.

The Interstate Commerce Commission has issued the second accident bulletin, which includes the months of October, November and December, 1901. It will be remembered that the railroads are required, under the provisions of the "Accident Law," to furnish the commission with particulars of all accidents which may occur from time to time, with the number of persons injured in each. In tabe No. 1, which is a summary of casualties to persons, the greatest number of accidents were due to collisions, and the greatest number of persons killed were in this class. There were 47 passengers and 152 employes killed, though injuries to both passengers and employes were greater from other causes.

In the matter of coupling accidents, in a table of twenty-one classified causes, the "not clearly explained" cause, contains the greatest number of victims. Eleven employes were killed and 147 were injured. The significance of these figures, where information appears to have been scanty, comes out when one sees that the total killed for all causes was 38, and the injured numbered 574.

It is probable that as the work of the commission in analyzing and tabulating the information sent in by the railroads, progresses, and furthermore, as the railroads themselves become more accustomed to furnishing accurate information, the classification of indefinite causes will decrease. The value of these coupling accident records depends entirely upon their accuracy. It was to do away with or mitigate the dangers incident to coupling cars that the safety appliance law was passed and the M. C. B. coupler introduced. If the information given in each case is definite, tables prepared from such returns will reveal what weak points there yet may be in our otherwise excellent system of coupling cars. It is directly in the interests of all employes, for the employes themselves to co-operate with railroad officials in giving the fullest details of each accident, so that not only may statistics be tabulated, but that remedies may be applied where any preponderance of casualties from some cause or causes, points to defects either in appliances or in operation.

General Manager's Report of the Natal Government Railways for 1901.

The annual report of Sir David Hunter, general manager of the Natal Government railways, shows that traffic and receipts during the year 1901 have increased in a very satisfactory way. Now that peace has been declared in South Africa, it is probable that a further very substantial increase of traffic may be looked for.

During that year the department added to its rolling stock 25 "Reid" engines and 365 wagons of 20 tons capacity. Additional orders for engines having been placed, the department will eventually have 100 heavy engines for working main line traffic, in addition to the existing stock. The engines referred to above were designed by the locomotive superintendent of the line, and they locally bear his name. They were built by Messrs. Dubs & Co. of Glasgow, and have ten coupled drivers, with a 4-wheel truck in front and a pair of carrying wheels at the rear. In fact they are what we would call 4-10-2 engines, according to their wheel arrangement. They are tank engines with tanks carried on the running-boards and fuel space behind. They have outside cylinders, and with familiar headlight and pilot have thus something "American" about their appearance. The cylinders are 19x27 inches, and the boiler pressure is 175 pounds. The engines weigh in working order 68.17 tons each. The gauge of the road is 3 feet 6 inches and it has numerous 1 in. 30 grades and curves of 300 feet radius.

These engines are not an unqualified success, if we are to believe an editorial

writer in the Natal *Industries*, a paper conducted by Mr. Robert Dives, M. I. M. E. It is stated that these engines were intended to haul 50 per cent. more load than the Dubs engines which had been on the road for 12 years. We are told that, so far, they have not come up to this promised standard.

An interesting side light is thrown on the methods pursued by the government in obtaining these engines. The critic, who is certainly hostile to the administration, professes to quote from the general manager's own notes, in a parliamentary paper on the subject. He says, "Between the time when Mr. Reid's first outline was made, and the arrival of the experimental engine, nearly seven years elapsed, and during the whole time very important discussions on every point involved took place between the engineer-in-chief, the consulting engineer, the locomotive superintendent and the builders."

It seems somewhat strange that after all this careful deliberation and manifest caution displayed by everybody concerned, an engine should finally have been produced which would be open to criticism from any quarter. It may be, however, that practice which was modern, and strictly up-to-date or even in advance of the times, when Mr. Reid's first outline was made, had withered away and had been forgotten by the time it had been wrought into iron and steel, and delivered to the Natal government nearly seven years later. We do not know how far the strictures contained in *Industries* may be justified; but it reminds us of the story of the sick man who called in half a dozen famous physicians to relieve him, and while these eminent practitioners were consulting together most carefully on the very best and most highly efficacious method of treatment, the patient died.

The Detroit Lubricator Co. are preparing to put upon the market a valve and piston lubricator designed to feed graphite with the oil. Those who are using graphite systematically on valves and pistons escape much of the trouble others have to endure from cut rubbing surfaces and particularly from trouble with metallic packing.

The Gold Car Heating and Lighting Company, which has just been incorporated under the laws of the State of New York, with a capital of one million dollars ($1,000,000) has purchased outright the entire business of the Gold Car Heating Company of New York, Chicago and London, and also the entire business of the Gold Street Car Heating Company.

It takes possession on July 1, 1902, of all of the property of both of these companies, and in addition to nearly one hundred patents already owned by them, has acquired a number of new and valuable patents covering electrical apparatus.

W. H. Nicholson & Co., of Wilkesbarre, Pa., had an exhibit comprising a full line of the Nicholson expanding mandrels. These handy appliances take everything from 1 to 7-in. holes, and occupy very little room. Mr. Wm. Lloyd represented the firm.

A lady desirous of seeing a very gorgeous private car at the Saratoga conventions, happened into the one belonging to the Railroad Gas Lighting Company, of Chicago. On getting inside she made some disparaging remarks on the undoubted plainness of the interior furnishings, but her attention was immediately called to the neat and compact nickel-plated gas range in one corner of the car, which compels the admiration of all. Thus, like Tom Sawyer's experience in fence coloring, "those who came to scoff, remained to whitewash." The car in question, named *Acetylene*, was brilliantly lighted by Acetylene gas. The generator is charged both with carbide and water from the outside, and it is claimed that this makes the system here employed very convenient and safe for use in passenger and private cars.

Our chief, Mr. Angus Sinclair, leaves New York July 2 on his biennial trip to visit his friends and relatives in Scotland. This year he goes on business connected with Railway and Locomotive Engineering and with the *Automobile Magazine*, which he controls. That will take him to several continental countries and he intends to make a careful investigation of the automobile business in addition to the notes which he always makes for Railway and Locomotive Engineering of the latest phases of railway machinery and operating in Europe. He expects to visit by automobile trips many places in his native country, among them Skibo Castle, the home of Mr. Andrew Carnegie.

Those who were financially interested in the Pan-American Exposition, held at Buffalo last year, are called upon to meet a deficit, the receipts having fallen short of the expenditures. Of course they are looking to the general government to make up the loss and a strong body is at work in Washington wrestling with Congressmen to help them to secure what they want. If that charity is granted, the next applicants will be those connected with the Charleston exhibition. After that will come the St. Louis World's Fair. These exhibitions are held for the benefit of certain individuals and to bring outside money to the places where they are held; there is very little reason beyond that for their existence and it is only fair that those benefited should be left to pay the bills.

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XV. 174 Broadway, New York, August, 1902 No. 8

Ten-Wheel Passenger Engines for the Central Railroad of New Jersey.

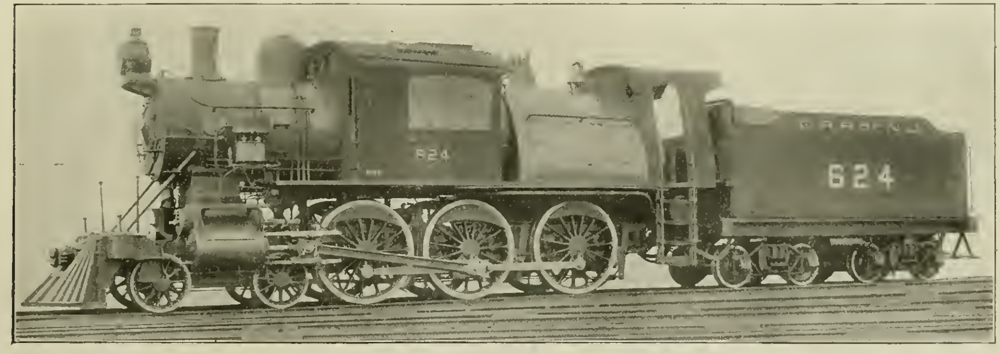
The Central Railroad of New Jersey have just received from the Brooks Works of the American Locomotive Company some passenger ten-wheel engines. The cylinders are 19 x 26 inches, and the diameter of the wheels 69 inches. The total weight is 161,000 pounds. Capacity of tender, 5,000 gallons.

The most noticeable feature is, of course, the fireman's cab, which is a complete steel hood, sloping inward toward the top, with a door at each side, which can be entered by means of a most convenient ladder. The engine frames are extended where the side thrust and lurch, due to high speed, is never in exact unison with that of the engine. In winter, curtains over the doors will make the "coal digger" decidedly snug, and furthermore, he can't fall out.

Another advantage in this plan is that it affords a very neat and compact arrangement for the shaker rigging. The whole is enclosed in a sheet metal box, close up against the firebox, and the lid is on the slant, so that the least room is occupied, and any coal which may fly off when the scoop "goes home" is not lost, but falls upon the deck, from whence it may be swept into the tender again.

capped pipe, and so do away with front gland and packing.

The valve motion is direct; the connection rod and rocker-arm being made of cast steel. The valve is of the piston type with inside admission. There is a half elliptic spring placed at the back of the spring system, where a coil spring is generally used. The sand pipes come down in front of the leading driver and are arranged so that the air valves are below the running board, and the pipes distribute themselves from that point to the various wheels. This gives a clear space between the main driver and the leader, and between the main driver and



TEN-WHEEL PASSENGER LOCOMOTIVE—CENTRAL RAILROAD OF NEW JERSEY.

back so as to carry a very roomy deck, upon which the fireman stands, while he feeds the wide furnace through two firedoors. The tender has a water bottom, and the coal space is sloped from the back, and comes out flush with the fireman's deck. The fire doors are not high, and the lift of the coal scoop is consequently not great. An advantage of having the fireman "on deck," and not working from the tender, is that, with all the motion of the engine, the fireman and the firehole door maintain the same relative position with reference to each other all the time. The fireman, as he works, experiences the heave and swing and sway of the huge machine, and his aim with the scoop full of coal, as he throws it forcibly forward, is more true and is attained with less effort than if he was compelled to stand on the shifting deck of the tender

The arrangement of fittings in the cab is all that could be desired, and may be accurately described by saying that everything is "handy," in full and real sense of the term. The cab is large and comfortable, and is provided with doors through which a man may walk without having to double up or squeeze through. There is not a cock, lever or valve of any kind on the fireman's side. This says more clearly than words, that on this engine the fireman's sole duty, with his steam gauge in front of him, is to "keep her hot," and the provision made for him by the company fully enables him to do so.

The engines are very popular on the road, they are well liked by the men, and are doing excellent work. The Jersey Central people intend to enclose the piston valve rod extension in a piece of

the trailer, which is very useful in enabling a man to readily get inside, between the wheels.

In the cab the water gauge is of ample size, but is enclosed in a case, which shows about 8 ins. of glass, so that when the water is "just in sight," the crown sheet has an ample supply above it. This glass enables an engineer to easily keep a more even water level, avoiding extremes and taking no chances. The result is comfort in the cab and a reduction of piston packing failures to be handled in the shop.

A few of the principal dimensions are as follows:

CYLINDERS.

Cylinder dia —19 x 26 ins.
Piston rod dia.—3¾ ins.
Steam ports, length—24.3 ins.
Steam ports, width—2 ins.
Exhaust port, least area—65 sq. in.

Kind of fuel—Fine anthracite coal.
Weight of leading wheels—41,000 lbs.
Weight on driving wheels—120,000 lbs.
Weight, total—161,000 lbs.
Weight tender, loaded—106,000 lbs.

GENERAL DIMENSIONS.

Total wheel base of engine—24 ft. 1½ ins.
Wheel base, driving—13 ft. 3 ins.
Wheel base, total engine and tender—51 ft 9¾ ins.
Length over all engine—38 ft. 5 ins.
Length over total engine and tender—60 ft. 5 ins.
Center of boiler above rail—9 ft. 5½ ins.
Height of stack above rail—14 ft. 11 ins.
Heating surface, fire box—156 sq ft.
Heating surface, tubes—2,031 sq. ft.
Heating surface, total—2,187 sq. ft.
Grate area—67.70 sq. ft.

WHEELS AND JOURNALS.

Wheels, truck, dia.—36 ins.
Wheels, driving, dia.—69 ins.
Material of wheel centers—Cast steel.
Journal leading axles—5½ x 12 ins.
Journal driving axle—8½ x 11 ins.

VALVES.

Valves—Piston.
Valves, greatest travel—5⅜ ins.
Valves, steam lap (inside)—1⅛ ins.
Valves, exhaust clearance (outside)—0.
Lead in full gear—$\frac{1}{32}$ in.

BOILER.

Boiler—Wagon top, radial stayed.
Boiler, working pressure—210 lbs.
Boiler, material in barrel—Steel.
Boiler, thickness of material in shell—$\frac{11}{16}$; ¾; $\frac{9}{16}$; ½ in.
Boiler, thickness in tube sheet—¾ in.
Boiler, dia. of barrel front—60⅞ ins.
Boiler, dia. of barrel at throat—69⅜ ins.
Seams, horizontal—Sextuple riveted.
Seams, circumferential—Triple riveted.

FIREBOX.

Firebox—Wide type.
Firebox, length—109 ins., width 91 ins.
Firebox, depth, front—59½ ins.
Firebox, depth, back—46 ins.
Firebox, material—Steel.
Firebox, thickness of sheets—crown ⅜ ins., tube ⅝ in., side ⅜ in.
Firebox, mud ring width—3½ ins. back, 3½ ins. side, 4 ins. front.
Firebox, waterspace at top—4½ back, 6 ins. sides, 4 ins. front.
Tubes, number of—282.
Tubes, material—Charcoal iron.
Tubes, outside—2 ins.
Tubes, thickness—No. 12 B. W. G.
Tubes, length over tube sheets—13 ft. 10⅛ ins.
Grates—Rocking and water tubes.

OTHER PARTS.

Exhaust nozzle—Single, 5 ins. dia.
Stack—Taper.
Stack, least dia. taper—15 ins.
Stack, greatest dia.—17 ins.

TENDER.

Type—8-wheel, steel frame.
Tank—Water bottom.
Tank, capacity—5,000 gallons.
Tank, capacity for coal—10 tons.
Type of underframe—Steel channel.
Type of trucks—All metal C.R.R. of N. J. standard
Type of springs—Triple elliptic
Dia. of wheels—33 ins.
Size of journals—5 x 9 ins.
Dia. of center of axle—5⅜ ins.
Length of tender over bumper beams—21 ft. 1½ ins.
Length of tank inside—19 ft. 6 ins.
Width of tank inside—10 ft. 0 ins.
Heighth of tank, without collar—5 ft.

SPECIAL EQUIPMENT.

Brakes—New York automatic brake for drivers, tender and train service
Pump—No. 2, N. Y. A. B.

One Hundred Miles an Hour.

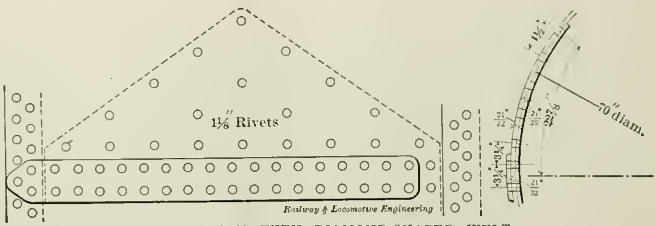
The results thus far attained by the experiments at Zossen, in Germany, where an electric road was especially equipped for solving the high speed problem with electric motors, show that the most important item is the roadbed. At speeds of one hundred miles an hour the track, which consisted of sixty-nine-pound rails, began to give way, and caused serious side-sway of the cars. Both the rails and the metal ties proved too light for the strain, and the experiments were stopped on this account. The original intention to run at speeds up to 125 or 150 miles an hour, while apparently perfectly feasible, so far as the motors and trolley mechanism were concerned, has had to be abandoned until a heavier roadbed can be laid.

Boiler Seam With Diamond-Shaped Welt.

Mr. Samuel M. Vauclain, superintendent of the Baldwin Locomotive Works, Philadelphia, has recently designed and patented a horizontal boiler seam, which is claimed to have 96 per cent. of the strength of the solid plate. This is a very substantial increase in strength, when it is remembered that the ordinary sextuple-riveted, double-welt, butt-joint has about 85 per cent. of the strength of an unperforated boiler plate. Mr. Vauclain's seam is a butt joint, with double welt, the under one being diamond-shaped. In the seam shown in our illustration there is one rivet, at the corner of the under welt, 22⅞ ins. from the butt joint. The tensile strength of the plate at this point is that of the entire sheet, minus one rivet-hole 1⅛ ins. in diameter. At a distance of 4½ ins. nearer the seam, the plate has its full tensile strength, minus two such holes, widely spaced, plus the shearing strength of the rivet at the apex of the triangle made by half the diamond welt. On the third row, it will be seen, the strength of the plate has been reduced by three widely spaced holes, but it is assisted by three good rivets in single shear. On the fourth row, the plate, weakened by four holes, is re-inforced by the shearing strength of six rivets. On the next line, just outside the upper welt, there are nine holes, but beyond them are ten rivets in shear. When we come to the double welt itself, there are 17 holes in it, with 19 rivets in the half diamond of the lower welt. All the rivets in the row along this welt are in double shear. This means that they pass through three plates, thus giving two planes where shearing forces act. Rivets in double shear are very nearly, though not quite, equal to twice the value of rivets in single shear, or those which pass through only two plates.

Adding together all the advantages and subtracting the disadvantages, if one may say so, or more correctly, taking the algebraic sum of all the additions to strength, and all the reductions of strength in this arrangement of plates and rivets, it has been found by test that this seam is about 90 per cent. as strong as the original plate itself. The diamond-shaped welt here used, secures this advantage, that on each line of rivets, the holes are comparatively few and far between, and as the seam itself is approached, the total number of rivets outside each succeeding line, almost make up for the loss due to the holes punched.

Like the breast pocket in a suit of overalls, the corners are not only top-sewed, but they have an auxiliary triangular patch on each, to prevent the fabric tearing away.



BOILER SEAM WITH DIAMOND-SHAPED WELT.

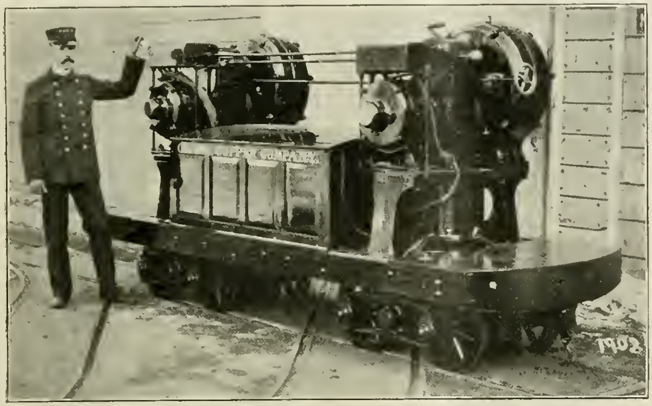
Electric Locomotives.

BY WALDON FAWCETT.

There has lately been a tremendous increase in the use of electric locomotives of the storage battery type in manufacturing establishments and on industrial and narrow gauge railroads in general. A representative locomotive of this type is possessed of a particular advantage from the fact that one man is enabled to handle an exceptionally large amount of freight. The locomotive is carried on two swiveling eight-wheel trucks, where every wheel is a driver, so that it is enabled to ascend the heaviest grades with comparative ease. It also runs smoothly around curves of twelve feet radius. Other economic advantages are claimed for electric locomotives aside from the fact that one man handles the locomotive and usually does more or less of the yard work, there being the further economy that when the

locomotive is not at work no power is being used or wasted.

The energy for the daily operation of an electrical locomotive is furnished by a storage battery, which is recharged at night or at intervals during the day when the locomotive is not in use. Very frequently it is possible to so arrange intermissions for recharging during the day, that no time need be devoted to this work at night. For the total recharging of the batteries there is required about one-quarter as much time as the locomotive has been in service since the last recharging.



ELECTRIC LOCOMOTIVE FOR INDUSTRIAL RAILWAY SERVICE.

The battery on the regulation electric locomotive is divided into sections which are connected through the controller with the motor armatures and fields in various combinations of series-parallel connections, thus obtaining the variations of speed and draw-bar pull required. Exceptionally large and heavy battery plates are used in order that there may be no possibility of overstrain in starting the load. In fact, an idea of the proportions of the storage batteries may be gained from the fact that they are required to deliver but two watts per pound of lead. The battery cells are not sealed, but are simply covered with a loose rubber plate intended to keep out dust and lessen the evaporation of the electrolyte. No rheostats or resistance coils of any kind are used. An effort has been made to so proportion the motors to the normal output of the batteries and to the weight of the locomotive, that they can not be overloaded by the driver.

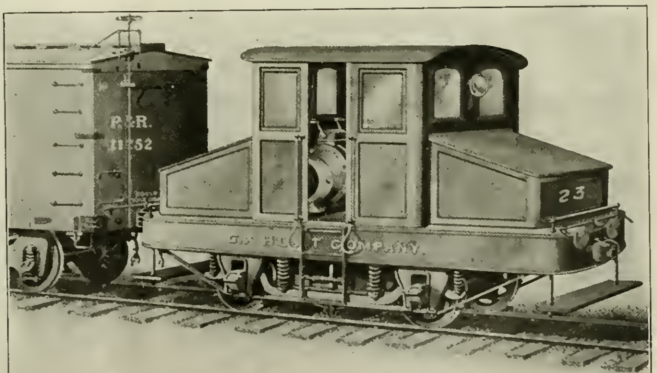
The ordinary locomotive utilizes two independent electric motors, either in series or in multiple. These motors are so adjusted as to pull hardest, when the load is being started and the speed is the slowest, gradually lessening the pull and increasing speed as the car gains headway. The locomotives in addition to being so designed that every wheel is a driver, are usually so geared that the motors have enough power to slip the wheels on the track. In electrical locomotive practice, it is the custom to estimate the draw-bar pull as one-fifth of the weight on the drivers.

In electric locomotives, the motors are not mounted between the wheels, as is the practice in street railway cars, because of the limited space below the platform. In many of the most modern types of electrical locomotives, however, the driving mechanism is entirely enclosed so that it would be possible for it to pass through half a foot of water without any working part getting wet. All gear wheels have machine-cut teeth and are mounted on steel shafts, which are ground true on dead centers and run in bearings with removable bushings. By means of a tight, circular case, the gear wheels are enabled to run in a bath of lubricating oil.

The great weight of the lead batteries, in proportion to the energy which they are capable of storing, precludes the consideration of storage battery locomotives for long hauls or high speeds, but for shop or yard work on tracks substantially level or with the short grades found in manufacturing establishments, they appear to meet all requirements. Storage battery locomotives, as compared with the trolley equipment, which they have in many instances displaced, are claimed to have the advantage of economy in the long run, and the storage machines have, of course, the advantage that they may be operated wherever tracks are laid, whereas trolley wires cannot well be run in erecting shops, machine shops or under overhead cranes.

Considering the subject of operating expenses, as applied to the storage battery locomotives, it may be said, generally speaking, that the current will cost about five cents per horse power per hour. The recharging of the batteries may be accomplished by an independent steam or electric-driven dynamo and accessories, exactly proportionate to the number and capacity of the cells. One charging set may be utilized to charge two or three locomotives in ordinary service.

The standard electric locomotive is thirteen feet in length over all, 52-in. width, 66-in. height over all, without canopy, and 100-in. height with canopy. The approximate weight of the locomotive in running order is 5 tons, and it is operated on a track of 21½-in. gage measured outside of rail heads. The speed per hour is variable, from one to four miles and the range in the usual run of shop and yard work is ten hours. A locomotive of the dimensions given, hauls, on the level, 50 tons; on 1 per cent. grade, 25 tons; on 2 per cent. grade, 15 tons; on 3 per cent. grade, 10 tons; on 4 per cent. grade, 7 tons, and on 5 per cent. grade, 5 tons. The most approved practice for industrial



ELECTRIC LOCOMOTIVE FOR STANDARD GAUGE.

railways, now prescribes the use of rolled steel rails 21½-in. from outside to outside of rail heads; riveted to cup-shaped steel cross-ties, spaced two feet apart and fitted with four bolt fish plates. The straight sections of track are 20 feet long and the curved sections 12-ft. radius. In most cases the curved sections are so constructed that the outer wheel of the car

runs on its flange, and the inner wheel on the tread of the rail.

In addition to their use on industrial railways, storage battery locomotives are coming into use to an increasing extent for switching work on standard gauge track. These larger locomotives which are, of course, constructed especially for this class of work, are built in accordance with Master Car Builders' standards and are in most instances arranged with two motors, so that every wheel is a driver, thus rendering the whole weight available for traction. The switching engines are of various capacities and a number have been built to suit particular services in yard work. Our illustrations show narrow gauge and standard gauge electric locomotives.

The First Successful Coal Burner and Its Modern Successor.

The first picture in the annexed engravings is the reproduction from an interesting model, which is an exact copy on a reduced scale of what is reported to have been the first locomotive on the American continent to burn coal successfully. It was a standard passenger engine on the Philadelphia, Wilmington and Baltimore for some years before 1865. The advances made in the design of locomotives since that time is graphically illustrated by the second engine, which is a picture of one of the latest locomotives built for the Philadelphia, Wilmington and Baltimore.

The introduction of coal for locomotive fuel is now a chapter of history with which few railroad men of the present generation are acquainted. The first locomotive to do work on a railroad in this country was Peter Cooper's "Tom Thumb," which demonstrated on the Baltimore & Ohio that traction by locomotives was practicable. That small engine used anthracite as fuel, but its successors for many years burned wood and that, too, on railroads whose principal business was hauling coal to the markets. Wood was the fuel of the people when railroads first were introduced, and the supply seemed illimitable, so it was natural that wood should be regarded as the proper fuel for locomotives.

Railroads had not, however, been many years in operation when firewood became scarce in some sections, and railroad managers began to urge the use of coal as fuel. The burning of wood had become the universal practice of locomotives and nearly everybody connected with their operation opposed any change. The conservative tendencies of railroad train men were displayed very strongly against a change of fuel; and those who were trying to introduce the use of coal met with open and covert resistance that discouraged the most strenuous efforts.

Among the most active advocates of the use of coal was Mr. S. M. Felton, who was an influential railroad manager between 1845 and 1865. In the latter year he retired from the position of president of the Philadelphia, Wilmington and Baltimore, and was the recipient of numerous evidences of esteem and respect from his former associates and from business men generally. Among numerous costly presents presented to Mr. Felton at a public banquet in his honor, was a miniature locomotive made of silver and gold, which was an exact model of the "Webster," an engine alleged to have been the first that successfully burned coal while hauling passenger trains. The construction of this engine was the result of long and persistent efforts made by Mr. Felton, who was determined that coal should be burned if the thing were possible.

The illustration shown was made from a photograph of the miniature model furnished us by Mr. S. M. Felton, president of the Chicago & Alton Railroad, who is a son of the celebrated railroad president to whom the model was given. At the banquet at which this model was presented, according to Ringwalt's "Development of Railroad Systems in the United States," Mr. Felton said:

"This beautiful and exact model of the first really successful locomotive for burning coal on passenger trains, is a touching and appropriate memorial, for it will always remind me of my trials, as well as my final success in that department. Many years ago while I was upon the Fitchburg Railroad, I came to the conclusion that if railroads multiplied in the future as they had done in the past, our beautiful and green hillsides would be stripped of their foliage and become barren wastes, unless some other fuel than wood could be found for locomotives. Accordingly in 1849 I got up a locomotive for burning coal. It succeeded, by a good deal of nursing, in making now and then a trip when all the circumstances conspired in its favor. It, however, served no useful purpose, save as a scarecrow to those who furnished wood, persuading them through their fears, that it was or would be a success, to reduce the price

THE "DANIEL WEBSTER"—P., W. & B. R. R.

PHILADELPHIA, WILMINGTON & BALTIMORE R. R. ATLANTIC TYPE.

of wood at once 50 cents a cord. So far so good; but it was not a success as a coal burner. It only paved the way to better things. . . .

"In 1855 Mr. Wm. A. Crocker, of Taunton, and myself built at our own cost and trouble, a passenger locomotive for burning coal on Mr. Dimpfel's plan. We were very sanguine of its success, but the subject was comparatively new. Engineers and firemen were used to wood, and coal was black and dirty to handle, and there were a thousand prejudices to contend with. We obtained leave to try some experiments on the Worcester and Western Railroad, as the locomotive was then in Massachusetts. Our second experiment there was with a very heavy passenger train loaded mostly with emigrants bound for Kansas. We proceeded successfully for twenty or thirty miles, and began to think that the problem was successfully demonstrated, when the engine began to lessen its speed. The pulsations of life grew less and less vigorous till finally the train came to a standstill. Then a storm of indignant rage was showered upon our heads by the delayed passengers. We were glad to retire from the crowd and procure another engine to speed the emigrants on their way. Then we examined at our leisure the cause of this most mortifying failure. The damper had been imperfectly secured in its open position. The motion of the engine had jarred down the damper so that no air was admitted to the grates and naturally the fire went out, as any wood fire would have done. Our engine, however, was condemned for this one failure, although it made successful trips before and after on other railroads, but we sold out at a loss of about eight thousand dollars. Thus ended the second chapter.

"The effort to burn coal was not, however, abandoned; but resulted in the building of the Webster, of which this is a model. The Webster was from the start an entire success, never making any failure. It ran at half the expense of wood burners of the same class and made the time so regularly and uniformly with the great express train that the residents along the line were in the habit of setting their watches by its passage past their houses."

Laying Two Miles of Track a Day.

Some very good track-laying work has been done recently on the Bessemer & Lake Erie Railroad by the use of a track layer, which consists essentially of machine car, from the front of which projects a 65-ft. steel cantilever truss. This truss is fitted on the under side with power rollers which move the rails forward. A tender car at the back of the machine car contains the boiler, fuel and water, all of which are carried on a raised platform.

A train of about 14 to 16 ordinary flat cars follow this machine, and each car carries two 3-in. iron rollers, placed in the center of the car, one over each side sill. Rails are loaded upon the rear cars of this train and are roughly connected up one by one on each side and move forward over these rollers as the power rollers on the machine car are operated.

Ties are loaded on the forward cars of the train, the lower tiers being laid longitudinally between the strings of rails, and on top of these lower tiers the ties are piled crosswise, so as to clear the moving rails. As the rails move forward, pulled by the power rollers on the machine car, ties from the front carload are laid crosswise on the rails, roughly spaced, so that the rails carry about the same number of ties as they will ultimately lie upon. Rails with ties across them move forward and pass under the raised platform of the tender car and enter the machine car. Here the rails move forward on the same level as formerly, but the ties are caught upon an endless chain and are taken up an incline until they reach the top of the projecting cantilever truss. They move forward along the top cord and are eventually slid down an incline 25 feet ahead of the last rail end.

The operation of track laying may be briefly summarized thus: When a pair of rails has passed out through the power rollers and reach the required point, they are grappled by specially constructed tongs and dropped upon ties already laid. A temporary connection of these rails with those in place, permits the machine car and the whole train to move forward. While this is being done ties are dropping off the down incline in front of all and are hastily straightened and placed. By the time the rails just dropped have been traversed by the machine car, ties enough have been laid to receive the next rail, which has gradually been pulled forward in the meantime. The stops made to allow rails to be connected up in front afford the men on the rear cars the necessary time to connect rails at the back end of the string.

The power for all this is supplied by a pair of 100 horse power engines. In the work already done by this track-laying machine no difficulty was experienced in moving 15 loaded cars up a 40-ft. grade. A crew of between 30 to 35 experienced men working this machine will lay two miles of track a day. Mr. Hurley, the inventor, expects to do away with the tender car in the next track layer he builds, and carry engines, boiler and all on the machine car.

The spring hangers on some of the heavy modern locomotives seem very light and frail. Unquestionably they are heavy and strong enough, but seem of insufficient material in comparison with the old-fashioned, cumbrous hangers as one is accustomed to see them. Since the light, modern hangers have proved a sufficiency of strength in service, the logical conclusion is that the old hangers were larger and heavier than was actually necessary.

Canadian Ten-Wheeler.

Our illustration shows a new ten-wheel passenger engine built by the Canadian Pacific Railway, at the Montreal shop, from designs made by Mr. E. A. Williams, superintendent of rolling stock. This locomotive was designed to haul the transcontinental trains of the company, which have been gradually growing heavier and time faster during recent years. The engines are simple with 20 x 26-in. cylinders, and 69-in. drivers. The boiler is 64 ins. inside the smallest course. The general appearance of the engine conforms to the regular C. P. R. design, which is plain and neat, and with rounded steel cab and turtle back tank, gives what may be called a smooth outline, all through. These engines are even more "clean" in appearance than usual, as there is no piping above the running-board, and on looking at the half-tone illustration, the puzzle is to find the sand box. It is made circular and fitted up around the radius of the boiler underneath, which gives a clear boiler above the running boards, also taking away the sand pipes. The motion arrangement is somewhat of a new departure from C. P. R. standard, as it has a straight arm rocker, which does away with connecting bars passing under leading wheels, this allows these wheels to be taken out without interfering with the motion. The cast steel eccentric and straps with bronze liners are also a new feature on these engines and have given every satisfaction. One may notice the absence of main air reservoirs hanging under the running boards of the engine; these reservoirs have been made to fit in between the steel frames of tender.

There were 12 of these engines built, of which the last three are compounds of the Pittsburg system. The tank holds 5,000 imperial gallons of water which would be in the neighborhood of 6,000 U. S. gallons, and the coal capacity is 10 tons. On the center of the cab window may be noticed a little glass shutter or wind guard, which is very popular with the men on the road. It consists of a light frame containing a pane of glass perhaps 4 or 5 ins. wide. This frame folds forward, flat against the cab window when not in use, but when in service it is drawn back and held by a small rod at right angles to the cab window. This enables the engineer or fireman to put head outside the cab, and sheltered behind this face guard, to see clearly ahead. It is very useful in rainy, snowy or stormy weather. It resembles the wooden wind guard used by the Pullman Car Co., for the convenience of patrons who desire to open the window but who do not wish to experience a violent draught of air.

The main drivers are not flanged and the engine wheel base is 24 ft. 11 ins.

Haulage of engine at a speed of ten miles per hour on a straight and level track about 4,100 tons back of tender.

PASSENGER TEN-WHEEL ENGINE—CANADIAN PACIFIC RAILWAY.

Some of the principal dimensions are as follows:

Haulage rate—120 per cent.
Total weight of engine in working order—173,830 pounds
Total weight of drivers—136,700 pounds.
Total weight on truck—37,130 pounds.
Total weight of engine and tender—300,430 pounds.
Total wheel base of engine—24 ft. 11 ins.
Driving wheel base—14 ft. 6 ins.
Wheel base of engine and tender—52 ft. 5 7-16 ins.
Cylinder—20 ins. dia by 26-in. stroke.
Driving wheels—69 ins. over tire.
Driving axle journals—9 x 12-ins.
Engine truck journals—6 x 10-ins.
Connecting rod, big end—6½ x 6 ins.
Main side-rod bearing—6¾ x 4⅞.
Boiler—Radial stayed with extended taper course.
Working steam pressure—210 pounds.
Boiler inside smallest course—64 ins.
Number of tubes—328.
Dia. of tubes outside—2 ins.
Length of tubes between tube sheets—13 ft. 2⅛ ins.
Length of firebox inside—10 ft.
Width of firebox inside—3 ft. 5⅝ ins.
Grate area—34.9 sq. ft.
Firebox heating surface—165 sq. ft.
Tube heating surface—2,262.9 sq. ft.
Total heating surface—2,428.9 sq.
Cab—Steel, wood lined, C. P. R. Standard.
Height on top of stack—15 ft. 2 ins.
Height of center line of boiler above rail—8 ft. 6¾ ins.

TENDER.

Total wheel base—16 ft. 9½ ins.
Truck wheel base—5 ft. 5 ins.
Dia. of truck wheels—40 ins.
Dia. of truck journals—5½ x 10 ins.
Type of tank—Hopper, with turtle top.
Tank capacity—5,000 imperial gallons.
Tank coal capacity—10 tons.
Tender frame—Steel throughout.

Special equipment W. A. B. driver and train brakes, etc. Commingler system of heating, Pyle-Nation electric headlights, Washburn flexible pilot coupler, Tower tender coupler, three 2½-in. "Star" safety valves, nickel steel piston rods from Bethlehem Iron Co. Magnesia sectional block lagging, Crosby steam gauge, one Michigan and one Detroit lubricator, Leach sand traps, Gollmar bell ringer, two No. 10 Gresham & Craven Automatic Restarting Injectors, steel cab, hopper tender, spring buffer between engine and tender.

The following details are made of cast steel: Motion radius links, rocker arms and boxes, crossheads, driving axle boxes, expansion brackets, eccentric straps, spring hanger brackets, dome ring and cover and all driving wheel centers.

Edison's Storage Battery.

Mr. Thomas A. Edison has an article in the *North American Review* for July in which he predicts the successful completion of experiments which he has been making for some time past. He has made four successful tests and the fifth is under way. The inventor claims that the battery is reversible, and is said to receive and give out current like a dynamo without any deterioration of the mechanism of conversion. The latter is, of course, very much lighter than any now in use. This battery has been promised for a long time; its actual appearance, if it does all that is claimed for it, will make it very welcome, indeed.

COMBINATION COACH.—C. R. R. OF N. J.

New Vestibule Coaches on the C. R. R. of N. J.

The Central Railroad of New Jersey people have recently received some very handsome vestibule coaches from the factory of the Harlan & Hollingsworth Co., of Wilmington, Del. The bodies measure 64 ft. over end sills, and 9 ft. 8 ins. over side sills, and there is comfortable seating capacity for 74 persons. These coaches are perfectly plain outside, no striping or ornamental scroll work is to be seen. They are painted in what is known as Pullman color and present an elegant appearance, probably due to the fact there is nothing striking to catch the eye, or take it from the rich, clean finish of the coach. The windows are arranged in pairs, the upper sash being filled with ornamental glass. This arrangement is what is known as Gothic, the windows having a long segmental top. The term Gothic, though understood to mean this form of construction in car building, does not appear to be a strictly accurate word when so used. The vestibules are of the latest Pullman extended type, with trimmings of bronze, and is supplied with spring roller curtains. The trucks are standard C. R. R. of N. J., 4-wheel type and are without striping or ornamentation of any kind.

The clearstory is very wide, and gives a roomy and airy appearance to the interior and should be an aid in solving the problem of ventilation. The interior is plain, well-finished mahogany, the striping effect being produced by strips of light colored wood, inlaid. The headlining is painted apple green, relieved with light ornamentation. There is nothing unduly severe in the decoration of these cars; good taste has been employed, and a very pleasing effect is the result. The cars should be easy to keep clean, as there is a complete absence of dust-collecting moldings and raised work.

A thermometer is placed on one side in the center of the coach, and across the aisle is a steam heat pressure gauge. There are also two ornamental brass candle-sticks placed diagonally fore and aft in the car for use should the car have to be used after the gas supply had been exhausted. The candles would not give very brilliant light under the circumstances, it is true, but they are only intended for use in such an emergency as would make "half a loaf better than no bread."

The combination baggage and smoker is the same size as the passenger coach, and has accommodation for 50 passengers. The combination car-seats are upholstered with Pantasote; the regular coaches are upholstered with crimson colored plush.

The cars are well finished throughout and are good examples of railroad design and car builders' skill. Our illustrations show a first-class coach, exterior and interior views, and the outside of the combination smoking and baggage car.

INTERIOR OF FIRST-CLASS COACH.—C. R. R OF N. J.

FIRST-CLASS VESTIBULE COACH.—C. R. R. OF N. J.

A Huge Success.

The hourly trains between New York and Philadelphia via the New Jersey Central have not only proved a great success, but have met the demands of the traveling public in every instance. Hourly trains were indeed an up-to-date move, and when the schedule is fast, the stops few, and the time so convenient to remember, (a train every hour and on the hour) there is no wonder at the hit they made. The New Jersey Central is trap rock balasted, the rails are new and heavy, the trains are the latest models, lighted by gas, the aisles carpeted, the attendants courteous, hard coal is used exclusively, hence no dust, cinders or smoke. Every Philadelphia train has a modern Pullman attached, and such conveniences serve to make the New Jersey Central the model railroad of the world. Write to C. M. Burt, Gen'l Pass. Agent, New York.

A Miniature Railway.

A short time ago a visitor to Central Park, New York, would have found at the north end a regular railroad, but of 12⅝-in. gauge. The engine used on this line was an eight-wheel type, roughly speaking, about ⅛ full size. It had cylinders 2 x4-in., with 10-in. drivers, and top of stack 28-in. from rail. This little machine weighs about 600 lbs. The tender is 3 ft. 5 in. long, 18 in. wide, with 15 gallons capacity. The engineer in charge occupies the whole of the tender, and so cannot legitimately claim the services of a fireman. He sits on a seat above the tank top, with his feet in the coal space, much as Gulliver might have sat upon the royal train of the king of Lilliput, supposing that monarch to have had one. The engine and tender are 8 ft. 9 in. long, over all.

This Lilliputian railroad doesn't haul freight, never has to give a defect card, and does not bother about ton-mile statistics, as its entire length of line was about ¼ of a mile long. It devoted itself to the pleasant task of carrying delighted passengers, and it is probably the only road in the world where passes are not demanded by all sorts of people for all sorts of reasons. The train consisted of ten cars, each holding two people comfortably, and the speed was about 10 miles per hour.

On seeing the railway one might be tempted to suppose that the whole thing was the work of some ingenious mechanic with a taste for model making, combined with an eye for the commercial value of novel enterprises, but this is far from the fact. The miniature railway is a cold, money-making, business "proposition," albeit a doll's railroad patronized by children, nurses and curious people generally.

These miniature locomotives are built at Cagney's Locomotive Works, at Niagara Falls, N. Y. There are two sizes made, the one we have described on 12⅝-in. track, and the other suitable for 15-in. gauge. This latter weighs about 1,000 lbs., and the top of the smoke stack is 36 ins. above the rail, cylinders 2¾ x 4 ins., drivers 16 ins. diameter. The builders tell us that they were compelled to design this larger engine "in order to retain the miniature size and at the same time furnish a locomotive which will do the business, which since their introduction, have in all places been heavily overtaxed, and which have necessitated the purchasing of extra outfits to accommodate the crowds which clamored to ride upon the smallest steam railroad in the world."

These little railways are scattered all over the country, and have been seen at many of the State expositions. Among the other things, it may be mentioned that the West Side Street Railway Co.'s park in Chicago has a miniature railway which is said to be the best money maker on the ground; there is one on the Midland Beach pier, Staten Island; Rockaway Beach, N. Y., has one; another is at Chestnut Park, Philadelphia; one at Tolchester Beach, Baltimore, Md.; still another at Richmond Beach, Staten Island, and there are three in South America. Our illustration shows the miniature railway as it was at the Pan-American.

The Cagney Locomotive Works, however, do not simply build engines for a joke, another and more important part of their business consists in the building of light locomotives for logging railroads and for narrow gauge industrial service. If one calls at 301 Broadway, New York, one will find that they have locomotives for the light work of pure amusement and fun, and also light locomotives for very serious work, which are worked nearly 24 hours a day and never see a laughing child, from the "ladle to the scrap heap."

LILLIPUTIAN LIMITED—MINIATURE R. R.

The President Remembers the Enginemen.

President Roosevelt entertains a very kindly feeling for locomotive engineers and has repeatedly manifested his good will towards delegations of engineers. An incident connected with the finish of a recent journey is thus described in the press dispatches:

"President Roosevelt and party arrived in Washington on a special train over the Pennsylvania Railroad at 10.35 o'clock this morning.

"The President walked briskly down the station platform on reaching Washington, and almost had reached the gates when he recollected that he had not bidden adieu to the engine crew, his invariable practice on returning from a trip. Quickly retracing his steps, he reached the side of the big engine that had pulled him from Philadelphia, and vigorously shook the hands of the engineer, fireman and another trainman who had climbed into the cab to share the honors."

"All speed records on Colorado railroads were lowered by the Pueblo real estate exchange special, run by the Colorado & Southern Railroad over the Santa Fe tracks," says a press dispatch. "The train covered the distance of 218 miles in two hours and thirty-one minutes, the actual running time being two hours and seventeen minutes. A portion of the run was at the rate of eighty miles an hour." That statement has very much the odor of the press dispatch order about it. A train that ran 218 miles in two hours and seventeen minutes would make a little more than ninety-five miles an hour. If the run was 118 miles, the distance between Denver and Pueblo, the speed was about fifty miles an hour, a poor thing to brag about.

General Correspondence.

Answers to "What Ailed this Engine."

Referring to your article on "What Ailed This Engine," in June issue, on page 246, will say that the bridge between the steam port and exhaust port was broken or frame was broken between steam chest and main drivers on L side, which would allow it to spread and let the valve lap over the exhaust port and blow directly through the stack. J. F. KURTH.

Fond du Lac, Wis.

In answer to question "What Ailed This Engine," on page 246 of June issue, would say: It was a back motion eccentric slipped, or the rod. I once had an experience with a Baldwin compound engine. I was sent out to see what was the matter with the engine. When she was on the dead center on the right side she would not move with 180 pounds steam pressure, but would stand perfectly still, but after she was started she would go. I had her brought into the roundhouse and I examined the left valve and found a piece broken out of the valve. A Baldwin compound will go with the valve stem broken off if it is inside the steam chest, but will pound terribly.

Now here is one for you with the answer attached. A passenger engine with the throttle valve ground in and perfectly tight, with full pressure of steam and no sign of a leak whatever, but the moment the throttle was opened she was as if she was wide open and could not be shut off at all. This is an experience I had with a passenger engine from the Reading shop when she arrived at Palo Alto. This is what was the matter: The engine had a steam pipe connected to the throttle chamber and the bolts became loose. When the throttle was shut before the engine was fired up the pressure would hold it shut, but when the throttle was pulled open a little the dry pipe would open and the steam would get between the joint and blow through and could not be shut off. The air brake would not hold her, so had to block her. W. W. HAY.

Pottsville, Pa.

Comparative Mileage of Freight Cars.

It may be of interest to car men and others to know what statistics show as to the comparative mileage of freight cars, before and since the adoption of the present practice of car interchange. The result may surprise them, for I think most of us have felt justified in claiming that we have helped to meet the demand of modern conditions in freight movement and are keeping pace with the other departments in the strenuous effort to move larger tonnage more expeditiously than formerly, and that each one is entitled to his own measure of commendation, whether he has contributed directly by recommending changes, or indirectly by carrying out the recommendations of others.

Referring briefly to the changes which have been made. One of them has been the adoption of agreements at large interchange points, whereby disputes between car inspectors of connecting roads, and consequent delay to cars, are avoided. There are two kinds of such agreements, one of which is called joint inspection, and the other a joint agreement, whereby the freight goes, whether the car does or not; if the receiving road refuses a loaded car, it must transfer and forward the load and return the empty car to the delivering road. Both plans have their advocates; the latter avoids the expenses of a chief joint inspector and his assistants, but it requires an outlay for transferring freight and returning empty cars, which is largely avoided by having joint inspection. I understand there are still some important interchange points where neither method is in force, and the old vexatious conditions prevail, but "the world do move," and all will doubtless get into line some time.

Another change which has contributed to the desired end, is the change made in the M. C. B. rules a few years ago, making car owners responsible for most defects on their cars. This renders an inspection for protection, so called, unnecessary, and the inspection of to-day is one for safety only, at least that is the theory, although there are roads that make a fad of wrong repairs and annoy their neighbors with trifling claims, which, if the practice became general, would again make an inspection for protection necessary.

It is by avoiding an inspection for protection that the prompt movement of loaded cars past junction points is made possible. That there is need enough of all our efforts to get the most service out of the freight equipment is illustrated by the following quotation from the Wall Street Journal.

"Few people outside the railroad business and perhaps not everybody in the railroad business, realize to what an extent the equipment of the railroad stand idle and unproductive. It may be interesting to note the experience of the New York Central on this point. This road is one of the largest in the country and is extremely well equipped with tracks of all kinds. Its average freight car mileage shows 10,597 miles per car.

This gives in a year with, say an average of 300 days for freight cars, an average daily mileage of 35 miles.

Reckoning an average speed of about 15 miles per hour for freight trains, gives an average of about two hours and twenty minutes' work in the day for freight cars out of the twenty-four hours.

Remembering that about 30 per cent. of the freight car mileage is run empty in connection with the return and distribution of cars, it appears that a freight car on the N. Y. Central road is earning money for about an hour and forty minutes during the day, is running empty for about forty minutes, and is idle for twenty-one hours and forty minutes, during which time it earns nothing. Thus freight car equipment, for about 93 per cent. of the time, earns no money.

It certainly seems strange that freight cars should be able to earn money for practically only twenty-one days of the year, or less than two days in a month. It is impossible to doubt that a great improvement can be made in the earning capacity of equipment by careful study on the part of railroad managers. Just at present when equipment is so expensive, the matter well deserves attention."

The efforts of the Car Department to avoid delays to cars at interchange points has been supplemented by the efforts of the Transportation Department to accelarate the speed of freight trains, therefore one would expect to find gratifying results shown in a comparison of mileage years ago and now, but it seems that the figures do not bear out our expectations and there are even some who assert that the mileage per car is less to-day than it was years ago and that we are not getting the same service as formerly. When we come to analyze that statement, we find it based on the claim that the average mileage twenty or more years ago, was seventy to ninety miles per car per day, but it is found that those figures include the mileage of special classes of cars. A careful review of such statistics as may be obtained, leads the Official Equipment Register and other competent authorities to state that they believe that the average of twenty years ago was in the neighborhood of 24 to 30 miles per car per day for railroad companies' cars and that the present average will be found to approximate those figures. If the facts are that, at best, the mileage is only about the same as years ago, how can we explain it? There must be some factors that counter-balance our efforts to expedite the interchange of cars and the increased speed of trains in recent years.

I find two causes assigned, and will suggest a third reason. It will be noticed that the averages referred to relate to mileage only, but we all understand that more tonnage is handled per car mile than formerly, both on account of increased capacity and also in the present practice of loading cars to their limit, and right there is one of the causes for the mileage

not showing up better; to load cars up to their capacity requires more time at terminals than if but part of a full load was put in.

Another cause is that terminal facilities for loading and unloading have not kept pace with the enormous increase in equipment. One writer states that since 1882 the equipment has increased 344 per cent. while the tonnage has increased only 200 per cent.

In addition to these explanations, I would suggest that perhaps our safety inspection is not accomplishing what we expected. It must be admitted that one result of making owners responsible for most defects on cars is that the cars are not kept up as well as when delivering roads were made responsible for many more defects than they are at present, so that now the safety inspection naturally cuts out more cars at inspection points that are in unsafe condition and more than under the former practice, and to that extent neutralizes the results expected from the elimination of inspection for protection. However, we know that our efforts are in the right direction, and we may flatter ourselves that if it were not for such efforts the average mileage would not be as great as it is, and not as much as in former years.

Cleveland, O. J. D. McAlpine.

The Expense of Mistakes.

In May issue, page 196, The Expense of Mistakes. If train dispatcher would ask engineer condition of his engine —himself and his fireman, before arriving at terminal, the engineer could let him know and also the roundhouse foreman. Then all concerned could tell within a very short time when they could get the engine—and train department could order trains accordingly. I think this would create a better feeling among all concerned. In my own experience I know that engine crews don't like to see the caller step on engine before she stops at round house. It is annoying to have call boy hand you the book and say, "Want you to go right through."

If you have been consulted before your arrival, you and the fireman have had a chance to make all preparations and time is saved—the round house knows what to do with engine and train dispatcher knows when to order trains. Try it and see if you don't save time.

Arnavillo, Texas. R. G. Knoll.

Advantages of High Pressure.[1]

To raise a pound of water from 32 degrees temperature and evaporate it into steam in open air requires about 1,146 heat units;[2] to evaporate it at 50 pounds pressure requires 1,167 heat units; at 100 pounds pressure, 1,181; at 150 pounds pressure, 1,190, and at 200 pounds pressure, 1,198. Thus the fireman may know that when once the water is hot enough to evaporate at a given pressure, it is nearly hot enough to evaporate at a higher pressure. Furthermore, one pound of water evaporated into steam at atmospheric pressure occupies 1,644 times its former space; at twice this pressure it occupies about 832 times its former space. When at 150 pounds pressure its space is reduced to 173 times, and at 200 pounds it occupies but 132 times the space of water. Thus the fireman may understand that the efficiency of steam increases as we approach a higher pressure at a ratio far exceeding the additional heat required to raise it.

[1]Based upon the table given in Barr's work on Combustion.

[2]Heat Unit.—The amount of heat required to raise 1 pound of water 1 degree Fah.

IMPORTANCE OF CLEANING ENGINES.

By careful study one may master the subject of combustion and be conversant with the details of locomotive engine running, but to accomplish success in a high degree requires labor and studious attention to business. There is no higher mark of efficiency than to see a fireman coming into a terminal with a clean engine. No kindly word spoken by the well-wishing engineer can so forcibly commend him to the consideration of his employers. But the fireman who arrives with paint work and windows smeared over, inside of cab dirty and disarranged, headlight casing not wiped at all, the globe and signal lamps smoked, drain holes in tank stopped, voluntarily marks himself as a negligent and unprogressive man.

NECESSARY DEPORTMENT.

Duty must always be uppermost in the mind of him who is ambitious of success. Distrust and misfortune follow in the wake of him who would shirk his duty. The age is yearly demanding more strict conformity to the best rules of society and making more apparent the expediency of avoiding offensive habits. A fireman should inform himself well, but never become arrogant and full of suggestions. He should manifest a kindly disposition towards his engineer, a willingness to accept his criticism and an eagerness to do his will. It has often happened that a novice at the throttle has looked down upon a genius in the gangway, destined to soon succeed him in knowledge and skill, but it becomes a fireman not to conclude that this is about to be the case of him and his engineer, and if he cannot escape the consciousness, to scrupulously conceal it. Submitting to those who are in a position of superior responsibility, is by no means a lack of self respect, but a mark of good discipline. T. J. Hoskins,

Traveling Fireman, Knoxville Division, Southern Railway.

Correction Re Mulholland Engines.

A friend, whose recollection proves to be more accurate than my own, calls my attention to an error in my communication, on page 300 of your July issue, as to the Mulholland engines with long firebox extended over the rear axle. I have, therefore, to correct my statement that the Mulholland engine, "Vera Cruz," built in 1857, was the first of this type, the fact being, as I now recognize, that the old "monster" engines of the Camden and Amboy Railroad, which date from about 1839, as well as the engines built by Richard Norris & Sons in 1854 or thereabouts, with Phleger boilers and with the modified form of the same termed the Norris boiler, fully embodied the feature which I have erroneously credited to Mr. Mulholland. The fact that the earlier engines referred to were not perpetuated in practice, while the Mulholland design was very generally adopted, may be a partial excuse for my oversight, but in any event, it is desirable that the facts of early history should be as correctly stated as is warranted by the data which is available.

Pittsburgh, Pa. J. Snowden Bell.

Savages Enjoy a Ride on the Cars.

Ubunu, the young King of Swaziland, appeared in full court dress, that is to say a forty-shilling slop suit, with a bowler hat, and attended by his "tail" of Indunas—about a dozen nearly naked Swazis—on the station platform at Barberton and waited patiently until it was almost dark, when the rumble of the train could be heard in the distance. With straining eyes they watched the track to see the flying wonder they had heard of. But when the engine, with screaming whistle and two great lamps glaring like the eyes of a monster dragon, rounded the curve and came screaming toward them, they fled like panic-stricken rabbits to the nearest cover, leaving their chief and the few white men on the platform to face the danger.

Next morning the chief reappeared on the platform with his "tail," and begged the acting stationmaster to show his Indunas the locomotive in less bellicose mood, and if it were humanly possible to give them a short ride behind it. As there was really nothing doing at the station, the stationmaster decided to humor the young chief's wish, and hooking an empty coal truck onto the locomotive, he told the driver to take them for a few miles' run along the line. Ubunu and his "tail" got into the coal truck, the stationmaster into the cab of the engine and off they set. It was "fair and softly" for a short distance from the start, and the Swazis seemed delighted with the new sensation, but the driver put on speed, and when it got to about twenty miles an hour his passengers were clearly in a great state of alarm; they grasped the side of the truck, and gazed like paralytics at the rocks and trees flying past them.

Ubunu did his best to reassure them, but in vain, and some of them were on the point of jumping overboard to escape a

worse fate, when Ubunu shouted to the driver, and asked him please to slacken the pace. No sooner said than done, and in little more than a minute their speed was reduced to that of an ox wagon. The Swazis were quite reassured, and were soon laughing and talking again as lively as ever. At a siding, half way to Avoca, they halted, the engine changed ends, and the return journey began. Ubunu gave the sign that he would like a bit of speed put on, and the driver, nothing loath, whipped her up until she was going between thirty and forty miles an hour. He imagined that the Swazis would get the funks again, for the road was not very smooth, and the truck was jumping about a good deal, but he was mistaken. The Swazis had seen enough to satisfy them that he was master of the "Smoking Horse," and a hundred miles an hour would not have shaken their confidence.

On returning to the station they got out of the truck with evident reluctance, but highly delighted with their adventure. The stationmaster was no longer a person of consequence. They crowded around the cab of the engine, made their most dutiful obeisance to the master of the Smoking Horse and his mate, and departed with shouts of "Inkoos, Inkoos." (Thank you, my lord, thank you.) SCOTSMAN.

Per Diem.

A prominent railroad official, well versed in car service matters, recently discussing the effect of the new system of car rental, made the following observations:

"With the adoption of the 'Per Diem' system of settlement for use of freight cars there will necessarily be an increase in the clerical force of the Car Accountant's Department to start with at least.

"In discussing this subject with car service officers I am of the opinion that many are overestimating the additional cost of the new plan while others are not figuring enough. As I have given the subject years of study it seems to me that there is only one way to handle this thing properly, and that is to have the fewest possible number of blanks and reports and to have them as simple as they can be, and yet give the desired information, or in the words of President Ramsey, of the Wabash, in regard to rules governing per diem, 'The fewer and more simple, the better.'

"After thorough investigation into the matter recently under the American Railway Association rules I believe that the following is the plan which will be introduced in most of the lines in the Central Traffic Association territory, which was unanimously adopted at the meeting of a number of car agents and distributing officers at Chicago, May 17 last.

"The present interchange reports of cars delivered from one road to another will be made out with the use of carbon sheets so as to furnish as many copies of the reports as are necessary, the delivering agent forwarding one to his car accountant and two to the agent of the connecting line (or as many as may be desired), already signed by the delivering line agent. One copy sent to car accountant of the receiving line, one copy filed with the agent of delivering line. This will decrease the labor and do away entirely with the present receiving reports.

"These reports will be worked as heretofore by the clerks in the car record office. They will then give them to the junction card clerk who will report cars to the owners, showing the car number, road delivering and point delivered.

"Many roads have agreed to send statements of car days in bulk at the end of the month. The car days will be figured from records the same as under the old mileage plan. In the statement of settlement at the end of the month, where the discrepancy is great enough to warrant checking, a detail statement will be requested which will then be checked against the records. Otherwise no detailed report is necessary.

"Under the plan outlined above, or a similar one, the extra work involved by the 'Per Diem' system will be reduced to a minimum."

A Boy's Essay on the Locomotive.

A prize of $10 was given by the Union Classical Institute for the best essay delivered at the annual commencement, and it was won by Albert Huntley White, seventeen years old, son of Mr. A. M. White, superintendent of the Schenectady Locomotive Works. The essay shows that the youth has imbibed a great many clear ideas about locomotives and locomotive building. He received no help from his father. The following are the principal parts of the paper:

RIVALRY AMONG BUILDERS.

"In order to understand clearly what a truly remarkable and wonderful feat is accomplished each time a new locomotive is made, let us devote our attention to the conditions existing twenty-five years ago, first, in regard to the firms or individuals that manufactured them; then, in regard to the locomotive itself as compared with the one which is constructed to-day.

"There was always the greatest rivalry and competition between the locomotive building firms. Usually one man owned the entire plant and he was in absolute control and was guided entirely in his work by rules and ideas of his own, and he was extremely adverse to following out the ideas of those who purchased and used the locomotives. The manufacturer constructed locomotives according to his own specifications, and when a railway company desired a new locomotive, one could usually be obtained at once from the stock on hand at one of the shops.

"For many years the roadbed of the railroads was very uneven and the rails were very light, 45 pounds to the yard being common. Bridges and trestles were made of wood and were not substantial. Bridges are now made of steel.

INCREASED WEIGHT OF ENGINES.

"The reason for the increase of the rails and for the greater solidity and evenness of the roadbed is that the weight of the engine was gradually increased. It was made heavier in order to obtain more adhesion to the rail when a long and heavy train was being pulled. The tractive power, or the power exerted on the wheels, has also been increased in proportion to the weight of the locomotive. It is well to say in passing that all builders have been making heavier engines than the roadbeds could carry, and this accounts for the necessary increase in the strength of the roadbed. The railway companies, in order to show proper earnings, were obliged to move freight at a reduced cost. As a result the locomotive was obliged to pull longer and heavier trains without extra cost for train service and fuel. The cost of repairs and principally, economy in the use of fuel, were necessarily very carefully considered. These conditions were met by improvements on the locomotive and so it was gradually changed for the better, until those in common use to-day have attained a high degree of perfection.

FREIGHT LOCOMOTIVES.

"A heavy freight locomotive now weighs about 200,000 pounds as compared with one less than half that weight twenty-five years ago. The heaviest freight engines built in America are of the Decapod type. This engine has five pairs of driving wheels and a two-wheel or pony truck. Besides the Decapod there are four other types which are in common use. The ten-wheel engine has three pairs of driving wheels and a four-wheel truck; the Mogul, three pairs of driving wheels and a pony truck; the Mastodon, five pairs of driving wheels and a four-wheel truck; the Consolidation, four pairs of driving wheels and a pony truck. These engines are built especially heavy and strong, and not so much attention is paid to speed. Although speed is sought for to some little degree in the construction of a freight locomotive, yet, in locomotives used for passenger service speed is naturally the most important element.

LIGHTER TO GAIN SPEED.

"In order to obtain this high degree of rapidity with which a train can travel, the total weight of a passenger engine is much less than that of a freight. We have said that a freight locomotive is built especially heavy in order to obtain adhesion to the rail. In passenger service the trains which are drawn are so much lighter in weight that less total adhesion is demanded. The weight on a pair of driving wheels of a passenger engine is to-day about 45,000 pounds, but twenty years ago it was only 25,000 pounds. The styles of passenger engines are not so varied as are those constructed for freight service. There are

but few different passenger types which are now used. The principal ones are: The eight-wheel type, which is most common, having two pairs of driving wheels and a four-wheel truck; the Atlantic type, having two pairs of driving wheels, a four-wheel truck and one pair of trailing wheels which are back of the driving wheels and directly under the fire-box. The ten-wheel type is largely in use on the Lake Shore and Michigan Southern railway. These engines are similar to the ten-wheel freight engines, but are especially designed for passenger service. They differ from the freight type in that they have larger driving wheels, increased bearings and journals and have considerable attention paid to lubrication, in order to prevent hot-boxes and troubles of a similar character which would cause a delay in train service. The passenger engine not only is taxed to the utmost to obtain a high rate of speed, but it also is obliged to carry a boiler which is large enough to heat all the cars and supply the steam required for air pump and the electric headlight. However, there have been many inventions which have tended toward the perfection of the locomotive as a whole. Among others, the following are some of the most important: The automatic air brake, various methods of filling the boiler with water, an automatic sanding device, and different means of lubricating the wearing parts. The boiler has received a large part of the attention of mechanical experts who desired to increase its steaming efficiency and its strength without increasing its weight.

ENGINE BOILERS.

"The boilers of freight and passenger engines do not vary a great deal in size and power, but those of passenger engines are generally a little larger than those of freight service, and they are, consequently, more powerful. The grate area of a recently constructed Decapod is a little over 58 square feet, while 25 years ago it was about one-half that area. The heating surface of the firebox is 210 square feet as compared with that of 139 square feet, and the heating surface of the tubes is 5,155 square feet, as compared with that of 1,370 square feet. We find that an engine then had a boiler, the smallest ring of which was 50 inches as compared with the boiler of a Decapod, which measures 79 inches diameter. The result of this increase in heating surface and area of grate surface has been that the amount of fuel consumed is much less in proportion to the work done. The consumption of fuel and the generation and economical use of steam have always received great attention in the designing of a locomotive. The results of much investigation and thought have been the balanced piston valve and various methods of compounding steam.

THE PISTON VALVE.

"The balanced piston valve is, to a great extent, displacing the flat slide valve, which works in a steam chest. This valve works in a circular chest, is entirely surrounded by steam, and is perfectly balanced. Although this invention lessened to some considerable degree the amount of steam used, yet by far the greatest economy was obtained by the system of compounding.

COMPOUNDING STEAM.

"There are four methods of compounding steam in use to-day. Twenty-five years ago the subject of this double use of steam was not considered practicable on a locomotive. The Von Borries system or the two-cylinder cross system is the most common. This system consists of having the high pressure cylinder on one side and the low on the opposite connected by a large pipe called the receiver pipe, which passes through the smoke-box where it receives some additional heat from the hot gases before they go out of the stack. This steam must also pass through a valve called the intercepting valve which has been the subject of many patents. The object of this valve, which contains a reducing valve, is to allow the engine to be worked as a simple engine in case of necessity. The function of the reducing valve is to reduce the high pressure steam to the proper pressure before it enters the low pressure cylinders, so that the power on the two sides of the engine will be about equal. The area of the low pressure cylinder is generally a little over twice that of the high pressure, so that the steam admitted to the low pressure cylinder will be about half that admitted to the high pressure cylinder.

THE TANDEM.

"Another system of compounding is known as the tandem, which consists of having two cylinders on each side of the locomotive with the high and low pressure cylinders being directly in line with one another, the smaller or high pressure being in front of the larger, or low pressure. These cylinders are connected with balanced piston valves.

ANOTHER SYSTEM.

"A third system consists of having the high and low pressure cylinders on each side of the engine with one above or below the other. This system is known as the Vanclain system and is the one advocated by the Baldwin Locomotive Works of Philadelphia. These cylinders are joined with one another and connect with one crosshead.

THE FOUR-CYLINDER FASHION.

"A fourth system consists of four cylinders, the two high pressure being connected with the outside of the driving wheels and the other two of low pressure being inside the driving wheels and connected with the crank axles. The value of compounding steam lies in the fact that the result of less use of steam means a saving in the amount of water evaporated and in the amount of fuel consumed. A reduction in the amount of water consumed means a longer life for the boiler because not nearly so much sediment and lime is deposited around the flues and the firebox. This is especially true of the engines which are used on the western railways, where the water is charged with lime to a much greater degree than in the Eastern States. The actual results in the use of compound engines during the past three or four years have been a saving in fuel from 15 to 20 per cent. over simple engines.

COMPOUNDING BEST ADAPTED TO FREIGHT ENGINES.

"It is generally conceded that the most effective work in the use of compound engines has been accomplished in freight rather than in passenger service on account of the long, hard, steady pull required of the freight engine. We have seen how, by means of compounding and various other improvements, the locomotive of to-day has reached an almost perfected stage. The locomotive of 25 years ago presented an outward appearance which would have contrasted strongly with the somber, graceful machine of today. One of the principal points then sought for was the presentation of as gay an outward appearance as possible. The engines were painted with bright colors and brass knobs and other brass fixtures were very common. To-day, most locomotives are painted black and no brass knobs are in evidence. The aim is to obtain a graceful, symmetrical appearance and to gain a high degree of perfection in the construction and working of the inner parts."

If you are going to travel be sure to take your eyes with you! Too many people travel blindly, without getting all the recompense to which they are entitled. They merely go somewhere, they do not travel in the true sense. There is hardly a mile of railroad in this country that is entirely devoid of interest. From the car windows one can, at almost every mile post, see something scenic, historic industrial or unique, that is worthy of notice. The traveler who does not anticipate his journey, and who knows nothing of the country through which his route may lead, misses the best of the trip.—From *Four-Track News* for July.

[Mr. Daniels means that the traveler shall not only take with him his eyes, but shall make use of the Sherlock Holmes observing faculty, the necessity of using which we speak of more fully in our editorial columns.—Eds.]

The Great Northern Railway is building new locomotive shops in St. Paul, Minn, at a total cost of about $180,000. The work is being pushed rapidly as it is desired to occupy them in the coming fall.

Caledonian Railway Ambulance Corps.

An ambulance competition recently took place between six squads of Caledonian railway employees at Stirling, Scotland. It was an entirely new departure in the annals of the "First Aid to the Injured" tournaments, which are a well known feature on British railways. In this instance the vice-president of the Stirling branch of St. Andrew's Ambulance Association offered four gold medals to be presented to the members of the best team. Each competing squad was composed of four men, so that altogether twenty-four men participated. The exercise took the form of an outdoor demonstration of treating and transporting the injured. So-called patients were placed at certain points, and each team was given a paper detailing the nature of the supposed injuries from which each patient was suffering. The teams were driven in ambulance wagons to the places where the patients were, and immdiately on arrival the work of "relief" was begun in earnest. On completing the necessary dressings and bandagings, the patients were placed in the ambulances and driven to the railway station, where a physician in attendance made a minute and thorough examination of the work done. The time occupied in each case was also noted. No. 6 team won, though No. 4 made a very close second.

These railway ambulance competitions are very popular in the British Isles. Competitions are often held at various divisional centers on a railway, and the local champions later on compete for the championship of their own line. The champions of each railway are eventually pitted against one another in an annual tournament for the championship of Great Britain. Railway officials and many prominent people attend these exhibitions of skill in "First Aid." In preparing for this work classes are formed, lectures are given, and certificates of proficiency are granted according to merit. The competition feature is added, to give a zest to the prosecution of this humane work.

Standard Methods of Cleaning Air Brakes and Additional Prices.

The M. C. B. Committee having consideration of the question of reducing, if possible, to a standard form the methods of cleaning air brakes, came to the conclusion that a standard could not very well be established, because of the varying conditions and facilities for doing this work in various railway yards. The committee, however, outlined in general terms what may be called "good practice," and among other things advised that triple valves should always be removed from a car for cleaning and that others previously cleaned should be substituted. The triples should then be cleaned carefully in the shop, gum and dirt should be taken off by the action of kerosene oil; metal tools should not be used for this purpose. The committee pointed out that care must be taken, in cleaning, not to enlarge the feed groove.

After cleaning, the triple valves should be subjected to tests, the form of which were given as follows:

Test No. 1.—The tightness of the slide valve, the emergency and check valves and all joints should be determined by painting with soap suds. Test No. 2.—Maintaining a pressure of 90 pounds in the train pipe, the auxiliary pressure should reach 70 pounds in not less than 45 seconds or more than 60 seconds. Test No. 3.—To test repaired triples for release, charge the auxiliary to 70 pounds pressure and make a full service reduction of 20 pounds, or until the auxiliary and cylinder pressure are equal. Place the special cutout cock in such position that pressure must pass through the 3-64-inch port, and turn main reservoir pressure of 90 pounds into the train pipe. If the triple does not release under these conditions it should be condemned. Test No. 4.—The triple piston packing ring should be tested for leakage by blocking the piston in the graduating position, maintaining the train pipe pressure at 70 pounds. Under these conditions the pressure in the auxiliary reservoir should not increase faster than 15 pounds per minute.

Curious Trees.

The tallow tree grows in Malabar. It owes its name to the fact that from its seed, when boiled, is produced a firm tallow, which makes excellent candles.

The butter tree was discovered by Park. It is a native of the central part of Africa. Its kernel produces a good butter, which will keep in excellent condition for a year.

The Palo de Vaca, or cow tree, grows upon a rock in Venezuela. If incisions be made in its trunk a kind of milk oozes out, which is tolerably thick and possesses an agreeable smell. At sunrise each day the natives of Venezuela may be seen hastening from all quarters with large bowls, into which the milk is allowed to drip after the tree is tapped.

In Madagascar is the travelers' tree, so called because of the copious supply of fresh water which it yields to the thirsty traveler. It is a native of arid countries, and even in the driest weather a quart of water may be obtained by piercing a hole in its leaf stalk. These leaves are of enormous size, varying from ten to fifteen feet in length.

Some one has said that a modern department store might be furnished from the date tree. This tree is a species of palm, and its every part is valuable. It is a native of tropical climes. The breadfruit tree also supplies many wants. For the inhabitants of the islands of the Pacific Ocean and the Indian Archipelago it furnishes clothing and food. Its fruit is nearly oval, and about the size of a child's head. The pulp is white and mealy and of a consistence resembling that of new bread. It is prepared for eating by being put in a hole dug in the earth and lined with hot stones. It is then covered with leaves and earth and left for half an hour. At the end of that time the outside is generally nicely browned, and the inside is a yellowish pulpy substance, highly nutritive and not very unlike wheaten bread.

A tree called the life tree grows in Jamaica. Its leaves grow after being cut off. Nothing kills it but fire.

A strange tree is the sorrowful tree. It blooms only in the evening, its first bud opening with the first star. As night advances the whole tree appears like an immense, fragrant white flower.

At dawn it closes every blossom and looks blighted all through the day, while a sheet of flower dust as white as snow covers the ground at its feet.

If this tree be cut down close to the root another plant shoots up and attains maturity with incredible rapidity.

In the vicinity of this tree there usually grows another, almost an exact counterpart, but, strange to say, it blooms only in the daytime.

"Made in America."

The new supplementary volumes to bring the twenty-five-year-old "Encyclopædia Britannica" up to date are about to be published; and as befitting a British work on an English subject, the article on railways has been "made in America." From the three specimen pages we have seen we fear that there are a number of mistakes in the article, as we discovered two in one page and a third on another. The most serious was the description of a type of locomotives as "single-coupled." Whatever that may mean we must leave to the imagination of our readers. "Single" locomotives we know, and "coupled" locomotives we know, but we are unacquainted with any type that can be distinguished by the compound appellation of "single-coupled."—*Railway Magazine* (London).

Railway Gauges of the World.

An interesting table prepared by the Baldwin Locomotive Works, of Philadelphia, shows the various gauges of railways for which they have built engines in all parts of the world during the years 1901 and 1902. They range from 18 ins. up to 5 ft. 6 ins. The table is as follows:

1 ft. 6 in.	2 ft. 11½ in.	3 ft. 9¼ in.
1 ft. 9 in.	3 ft 0 in.	4 ft. 0 in.
1 ft. 11⅝ in.	3 ft. 3⅜ in.	4 ft. 1 in.
2 ft. 0 in.	3 ft. 4 in.	4 ft. 8½ in.
2 ft. 2¾ in.	3 ft 5 in.	4 ft 9 in.
2 ft. 3 6 in.	3 ft. 5½ in.	4 ft. 9.07 in.
2 ft. 5 in.	3 ft. 6 in.	5 ft. 3 in.
2 ft 6 in.	3 ft. 7½ in.	5 ft. 5.83 in.
2 ft. 11 in.	3 ft. 8 in.	5 ft. 6 in.

M. N. Forney's Feed-Water Heater for Locomotives.

A British thermal unit is the quantity of heat required to raise one pound of water through one degree. If the average temperature of water in a locomotive tender is 60 degrees, it will take 1,171.1 units of heat to raise each pound of water to steam at 200 pounds pressure. If each pound of feed-water is increased 12 degrees in temperature, by waste, heat, before it enters the boiler, it will be equivalent to a saving of one per cent. of fuel required to convert it into steam. There can be no doubt that an amount of heat more than sufficient to produce this and a much higher degree of economy, escapes from the chimneys of locomotives; the difficulty is to utilize it by heating the feed-water, and doing it without costing more than is saved.

Mr. M. N. Forney, 501 Fifth avenue, New York, has recently designed and patented a locomotive feed-water heater, which he has described and illustrated in a pamphlet of 16 pages, from which the foregoing is a fragmentary extract. He has arranged the heater in two parts, one he calls the *exhaust heater,* because some of the exhaust steam is made to come in contact with pipes containing feed-water, and the other part he calls the *fire heater,* because the waste gases of the smoke box are made to augment the temperature of the feed-water, which has received its first increase of temperature from the exhaust steam.

The description of the apparatus is briefly as follows: Fig. 2 is a longitudinal section of the front end of a locomotive boiler and smoke-box, with an exhaust and fire-heater; 13 is the fire-heater, which is bolted to the front end of the smoke-box by angle-iron flanges 23, and 26 is the exhaust-heater located below the fire-heater. Fig. 3 shows the two vertical half-transverse sections.

The exhaust-heater 26 consists of a crescent-shaped vessel made to conform to the contour of the cylindrical fire-heater 13 above it. The outside shells of both are made of boiler-plates, excepting the ends 28 28' of the exhaust-heater, which consist of cellular castings having double plates with water-spaces between them. It is provided with a series of bent tubes 27 27' 27", Fig. 3, which are connected to the inner plates of its heads. The spaces between the plates are divided by partitions, one of which, 32, is shown to the left side of Fig. 3, and another, 32', is represented by the serpentine lines in Fig. 5, which is a half sectional view of one of the heads of the heater. The tubes are bent to correspond to the form of the heater and to permit them to be expanded and contracted by changes of temperature.

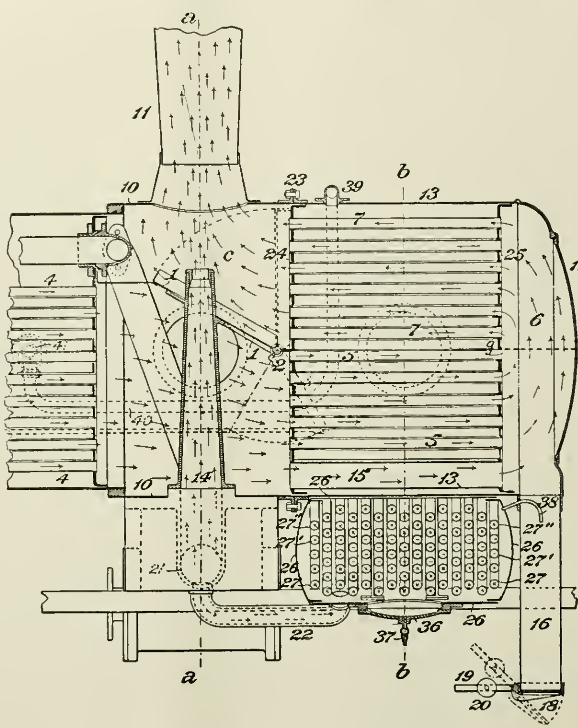
The feed water is conducted from a pump or injector to this heater. The direction of the flow of water is indicated by the arrows in pipe 30', Fig. 5. From the latter figure it will be seen that the water passes from the pipe 30' to the chamber 30" and downward to 30''' and thence into the tubes 27. In order to indicate in the end view of the tubes, in Fig. 5, the direction of the flow of the water a × mark is used to show that the flow is *from* the observer and a — mark that it is toward him. From the two figures last referred to it will be understood that the water enters the lower series of tubes 27 27—which are represented by dotted lines on the right side of Fig. 3—and flows through them to the chamber 33 on the left, as indicated by the arrows. There the current is reversed and flows back toward the right, through the tubes 27' 27', to a chamber at the right hand and adjacent to 28', where the current is again reversed and the water flows back through the tubes 27" 27" to the chamber 34, from which it is conducted to the fire-heater 13 above by the passage 35.

Exhaust steam is conducted from the exhaust pipes 21, of the cylinders, to the exhaust heater, by pipes 22, 22, Figs. 2 and 3. The bent heating tubes 27, 27', 27" are thus surrounded and exposed to exhaust steam while the engine is working. The water has to flow to and fro three times through these pipes and it takes up a good deal of heat from the steam. The water of condensation is drawn off from the little well by blow-off cock 37. The exhaust heater has 88 tubes 2 inches in diameter, giving about 200 square feet of heating surface.

It is a well known fact that the effect of heating various kinds of water is to cause a deposition of impurities as soon as the water becomes hot. To facilitate the cleaning of these tubes, each has a hand hole and cover 29, Figs. 3 and 4 opposite its end. It is thought preferable to catch impurities of this kind before they enter the boiler, even if a certain amount of trouble is entailed keeping the heater tubes clean. If this expectation of depositing impurities in the heater is realized, the economy resulting therefrom would, in many places, be very great.

The fire heater 13, Figs. 2 and 3, consists of two series of heating tubes 5_1 5_1 and 7_1 7_1 Fig. 2 enclosed in a cylindrical shell attached to the front of the smoke box. This shell has suitable heads to which the heating tubes are connected, and it contains around the tubes the water to be heated. The waste gases from the boiler are caused to pass through these tubes before they escape out of the chimney, and thus impart some of their heat to the feed water.

The heater represented has 412, 2¼-inch tubes, 3 feet 8 inches long, and has 890 square feet of heating surface. The temperatures in the smoke-box when a loco-



FORNEY'S FEED-WATER HEATER.—LONGITUDINAL SECTION.

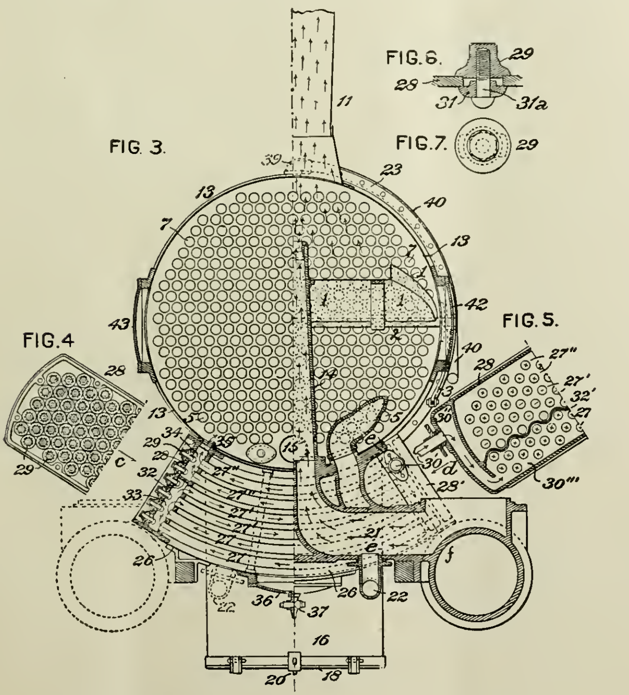
motive is working under steam, vary from about 400 to 1,200 degrees. With that amount of heating surface and such temperatures a very large amount of heat would doubtless be transmitted to the feed-water—how much cannot, of course, be determined, excepting by actual test, but, as already pointed out, these figures indicate not only the possibility, but the probability, of a saving of a very large percentage of fuel, and, in places where bad water is used, a very material saving in the cost of boiler repairs may be secured by arresting the solid constituents in the water and depositing them in the heater-pipes and thus excluding them from the boiler.

When a feed-water heater is used the consumption of steam by an injector is a matter of much importance. It is a fact established by careful experiments that with a steam pressure of 200 pounds it takes about 10 per cent. of all the steam generated by a boiler to operate the injector, or in other words it takes 1 pound of steam to put 10 pounds of water into a boiler. It is true that a considerable quantity of the heat of this steam is imparted to the water and is returned to the boiler, so that it is not wasted, but a pump operated by steam working expansively will require only about one-tenth or one-twelfth as much steam as an injector, to force a given quantity of water into a boiler. The pump, however, will not heat the water, but if a boiler is fed with a pump and the feed-water is heated by exhaust steam or the waste gases, then clearly there is a saving of about 9 per cent. of all the steam generated, because the pump takes only about one-tenth as much steam to work it as an injector does, and if the feed-water from the pump is heated it may be delivered into the boiler at the same temperature as it is by an injector.

To get the full advantage of heating feed-water it is therefore essential to feed with a pump and not with an injector, excepting when the engine is standing still or in emergencies. It is therefore proposed, in using the feed-water heater here described, to feed the boiler in regular service with a pump having a variable stroke, so that the quantity of water fed can be accurately regulated to the amount of work done.

The fire heater is so arranged that its tubes are placed opposite those of the boiler, and the former being of larger diameter, a boiler tube can be taken out and passed through the heater tube without disturbing anything.

A modification of this heating arrangement, intended for use on engines supplied with water full of rapidly incrusting impurities, has been designed. It can be more easily removed from the smoke box in its entirety and affords increased facilities for cleaning out the deposit.



FORNEY'S FEED-WATER HEATER—TRANSVERSE SECTION.

Oilsprinkled Roadbeds.

It is reported that the Boston & Maine and the Boston & Albany Railroads are about to discontinue oiling their roadbeds, after a three-year trial. The N. Y., N. H. & H. has also given up the practice, and the Long Island Railroad discontinued the practice about a year ago. Several of these roads are ballasting the permanent way with broken stone which, after the rain has thoroughly washed it, gives no further trouble from dust.

Elsewhere the oiled roadbed is giving every satisfaction. On the Atchison, Topeka & Santa Fe, when the road was first oiled, enough was put on to penetrate the ballast to a depth of 4 inches. From 2,000 to 2,200 gallons to a mile of single track is used at a cost of from $35 to $45. The treatment leaves the fine sand which flew in clouds about a train firmly anchored to mother earth and with the appearance and consistency of brown sugar. It is claimed for the oiled roadbed that the oil destroys vegetation along the line and thus saves the cost of weeding, also that it helps to preserve the ties by rendering the track waterproof and that it deadens the noise. Many ordinary highways in the West have been "oiled" with satisfactory results.

Japan Tries Some.

Our Consul at Tokio reports that in 1901 six American locomotives were ordered for the Hokkaido Government Railways, says *The Mechanical World*, and a number for private institutions in the Main Island and Kiushiu. The Government Railway Bureau for the Main Island had specified for British locomotives only for some years past, but the last tenders, opened about the end of 1901, included one American maker, the Schenectady Locomotive Works, and four British makers. The order went to the United States, the cheapest British price for all thirty locomotives being £86,795; the amount for which the contract went is £77,442. This is the first time that the Government have placed British and American makers in competition on the same specification. The makers were given a free hand as regards design, and, with the exception of the tires, they were not bound to any particular manufacturers for the material. One reason assigned for the preference thus given to American locomotives is the presence in Japan during the past year of a representative of American locomotive builders, including the Schenectady Works, and no doubt his labors were instrumental in carrying off the work to the United States.

The Falls Hollow Stay-bolt Co. have lately received numerous orders from the Government for stay bolts to be used in boilers belonging to the navy. The stay bolts for the navy are of steel, and some of them are over 2 inches in diameter.

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Using the Eyes.

It is expected that one of the committees to report at the mechanical conventions will devise some method of training that will develop the observing faculties that all persons possess as a natural inheritance, but which are stifled and in some cases almost obliterated by want of use. Nearly all readers of fiction, and theater goers, have received much entertainment from the stories of Sherlock Holmes in which Conan Doyle has wonders performed by the power of keen observation, and by the acute reasoning between cause and effect. It may be that some detectives have their powers of seeing things abnormally developed by incessant use, but the ordinary persons, especially those living in cities, have their powers of observation stunted through disease from their youth upwards. Readers of Fennimore Cooper are familiar with the importance of keen habits of observation among the Red Indians, and how sharp their perceptions were to note the meaning of things that would seem trifling to others. The Leather Stocking Tales, of course, are fiction; but the real habits of the Indians are portrayed faithfully from life. The existence of wild tribes was to a great extent dependent upon observing signs of enemies, and of the animals on which they subsisted, and so their education consisted to a great extent in learning to see things and to reason upon them. The trend of modern education has the opposite effect upon young minds. It tends to educate the memory at the expense of all other faculties, and the faculty of observation appears to suffer most. A boy or girl reared in the country is likely to develop the observing faculties much more strongly than the city youth, because their pleasures and pastimes depend very much on phenomena that appeal to the senses of sight and hearing. The educators of half a century ago were fond of providing reading matter that dwelt on the wonderful knowledge which could be gleamed by observing habits; but modern school books almost entirely ignore the training that comes through the eyes. Here is a story from an old fashioned school book:

One day a monk was traveling alone in the desert, when he met two merchants. "Holy man," said one of the merchants, "we have lost a camel."

"Was he blind in his right eye and lame in his left leg?" asked the monk. "He was," replied the merchants.

"Had he lost a front tooth?" asked the monk. "Yes, he had," said the merchants.

"Was he loaded with wheat on one side, and with honey on the other?" "He was," answered the merchants. "Then I have not seen your camel," said the monk.

The two merchants were now very angry. They declared that the man must know all about the camel. They therefore seized him, and carrying him to the nearest town, dragged him before the judge.

The merchants told their story to this judge, who was inclined to think the monk knew more about the camel and the thieves than he chose to tell. However, he commanded the monk to answer his accusers before he condemned him.

"How did you know the camel was blind of one eye?" asked the judge. "I knew the animal was blind of one eye because it had cropped the grass only on one side of the path," said the monk.

"How did you know it was lame in the left leg?" inquired the judge. "I knew it was lame in the left leg because I noticed that one of the footprints on that side was not so deep as those on the other," replied the man.

"How did you know the camel had lost a tooth?" asked the judge. "Because," said the monk, "wherever it had grazed a small tuft of grass was left in the center of its bite."

"But how could you tell with what it was laden?" cried the merchants. "Tell us that." "As to what the beast carried," answered the man, "the busy ants on one side and the flies on the other showed me that wheat and honey were its burden.

"And more than this, my friends," said he, "I think the camel has only strayed away, and is not stolen, as there were no marks of any footsteps either before or behind."

The judge listened very attentively to all the monk said, and then, turning to the merchants, bade them go and look for their camel. They did so, and found the animal only a few miles from the spot whence it had strayed.

The boys belonging to one school where that book was used were in the habit of playing at what they could see by walks in the neighborhood. To be sure the school master encouraged that kind of play, and used to ask the children what they had seen, and the older ones became very grasping in taking in details that were not apparent to every eye. We have no doubt that the tendency instilled by that kind of amusement stuck to most of the players through life, and that their ability to see things increased their usefulness in the walks of life they were destined to follow.

Having certain employees possessed of well developed faculties of observation is of very great importance to railroad companies. An engineer whose eyes have been trained to notice the condition of every nut, bolt, joint and connection as he makes his rounds at the engine house or on the road, is likely to apply the stitch in time that repeatedly prevents serious breakage and in many cases expensive accidents. Another engineer may be of even more careful habits than the first one, but nature or developed practice has not given him the same keen vision for seeing details that the other man possesses, and in the practice of inspecting his engine, he occasionally overlooks a loose nut or a bolt missing and an engine failure results. The man is not to blame for the accident for he has done his best; but it is highly probable that a course of training in seeing details would greatly sharpen his powers of noting details. There is another class of man who has no faculty whatever to see details without going laboriously over every part, and such a man is nearly always in trouble. He is of the same type as the painter who can portray an attractive landscape which is faithful to nature in the general outline but contains no details. He can see that the engine has a boiler and cab, he would miss the dome or a pair of driving wheels, and he has an eye for everything being clean and cheerful, but small details do not touch his consciousness.

Something ought to be done to find out if other men doing important work have the faculty of seeing things, and

when they are found defective they ought to be subjected to training. Car repairers, car inspectors, track walkers, and a variety of other railroad men are employed on work where it is important that they should have keen powers of observation; but it is safe to say that no inquiry is ever made when they are appointed as to men's capabilities for doing their work properly. The faculty of seeing things can be cultivated as easily as the memory. It is said that Macaulay, the historian, had such a quick grasp of details by vision that he could walk past a shop window and on glancing at the contents tell all there was to be seen. That is a special form of training whose value is not appreciated.

President Waitt's Inaugural Address.

The address delivered by President Waitt at the opening of the American Railway Master Mechanics' convention formed an ideal introduction to the proceedings of that association's annual meeting. It was an excellent review of the progress made lately in locomotive engineering, and contained numerous suggestions concerning the work which the association ought to carry out in the future, besides expatiating in a suggestive way about numerous problems which railway men are doing their best to solve. Limited space prevents us from publishing the address in full, but we expect to place before our readers in other pages the parts that will be read with the greatest interest.

The sections of the address relating to the development of the locomotive deal with facts well stated and about which there will be no difference of opinion. We were glad to hear the very sensible remarks which Mr. Waitt made on the subject of tonnage rating, and trust that they will be read by all the operative railroad officers in the country; for it is true that tonnage rating became a fad in many quarters and engines were habitually rated beyond their capacity, with the result that trains made such slow time that the movement of freight was seriously impeded instead of being accelerated. Much tribulation taught many railroad companies that giving a locomotive a load which could be hauled on the level at twenty miles an hour or over was a much better and more expeditious method than loading an engine to a ten miles an hour pace. We believe that the New York Central was one of the roads that profited by experience which proved that a moderately traveled locomotive earned much more revenue than one loaded to its last car. Those who have not yet come round to this way of thinking are behind the times.

The remarks made about the advantages of organization in conducting the mechanical department of railroads deserve to be carefully considered by the class of motive power men who try to do all the supervising themselves. An overworked official is an expensive luxury for any establishment employing labor, and its expensive effects are by no means confined, on railroads, to the mechanical department.

"Good shop practice and methods" is a department where good organization proves particularly efficient. It is a melancholy fact that many very inferior mechanics claim to be capable of doing railroad work, and exacting supervision is necessary to prevent inferior work being covered up and left to give trouble on the road.

The discussion of piecework for shops was very fair. It is a sad commentary on the history of the piecework system for shops that its advocates have to use so many "ifs" in commending its introduction. On this head Mr. Waitt said:

"In introducing piecework it must be done with absolute fairness, and in a manner to show the mechanic that if he maintains a fair output, he is guaranteed the equivalent of his day rate of pay, and is given the privilege of greatly increasing his wages by means of an increased output, and will not be curtailed because he puts in unusual efforts and draws high monthly pay. A piecework basis should be made clearly advantageous to the mechanic, while retaining part of the benefit for the company. A price should be carefully established, and it should be understood that when it is established it will stand for three, or better, six months, before revision, unless some material change is made in the tools or facilities for getting out the work. In revisions ot prices an equal division may properly be made between the mechanic and the company.

"Above all, straightforwardness and fairness, by all concerned, is necessary to success in introducing a piecework system, or any new system affecting relations between the employer and employees."

The railroad companies who wish to be fair toward their workmen in the introduction of piecework have to fight against an inheritancy of injustice inflicted in the past which has set workmen against all forms of piecework, for they reason, from past experience, that piecework is going eventually to increase their burdens without increasing their compensation.

The recommendation made of employing a specialist to devote his time to studying coal and the methods of handling it deals with a question which has been repeatedly discussed in these columns. We do not know of any official who would save so much money as that one if the selection were judiciously made. Under this head Mr. Waitt said: "Among the means for improvement in locomotive service 'a careful and systematic study of engine failures' will be found productive of great good. In order for this to be the most beneficial there is necessity for complete information, and a record of each case, followed by the weekly or monthly tabulation of the cases under their appropriate headings, and a careful study of each class, and the causes producing them. Such a study will enable the weak parts or those of defective design to be quickly located, and necessary modification in design made. If bad practice exists it will be clearly shown, and the remedy can be applied."

A variety of other subjects were discussed in a wide comprehensive spirit. The ties of friendliness and confidence between the whole strata of railway employment would be much closer drawn, if Mr. Waitt's recommendations were followed.

Air Brake "Parasites."

The consumption of air pressure generated by the pump of the air brake system for use by other devices than the air brake, on locomotives and cars of the modern railroad train has become quite an important matter. Originally the full work of the air pump on the locomotive was to supply pressure for the use of the air brake system. Now it is quite different. Persons recognizing the conveniences and characteristically favorable qualities of compressed air for other purposes began using it. Its first use, aside from air brakes, was to raise water in sleeping cars from tanks underneath the floor of the car. In the early days this operation gave much trouble to the air brake system. Air was taken direct, through a non-return check valve, from the train pipe of the sleeping car to the water tanks under the floor. Later, an improvement was made whereby the pressure was made to pass through the triple valve and auxiliary reservoir of the air brake, through a governor and non-return check valve to the water tanks. This arrangement prohibited the water-raising system from receiving its air until after the air brake system had accumulated almost its own maximum pressure of, say, about 60 lbs. This system has given very little trouble, and is in successful operation at the present time.

The use of air pressure for operating auxiliary devices on locomotives is greater than is such use on cars, and to-day we see on the modern locomotive such pneumatically operated devices as the automatic sander, traction increaser, fire-door opener, grate shaker, smoke consumer, bell ringer, water scoop and other similar devices. In the aggregate these devices consume a very considerable quantity of air, and, in fact,

equally as much as, if not more than, the air brake system itself. It is, perhaps, not the actual amount of air required for the legitimate operation of these devices that demands attention, so much as it is the waste or leakage from indifferent and careless maintenance of these devices. If they and their pressure connections were carefully inspected and properly maintained the amount of air consumed would be very much smaller, and the complaints made against such devices would be much fewer.

So serious have the complaints against these devices commonly known as air brake "parasites" become, that relief of some kind has been asked for, and in some cases, demanded. An investigation into the situation and a careful consideration of means for meeting the issue has pointed out two or three ways of escape from the trouble. One is to use steam pressure on all such devices on the locomotive as will permit of it. This, however, has its objections, inasmuch that steam leakage leaves a sediment which is unsightly and unclean, and is quite different from that caused by clean air pressure. On the other hand, with the use of steam, leakage would manifest itself at the several bad joints by the forming of sediment and scale, thereby directing the attention of the inspector to the leakage, when the repairs could be easily and quickly made. On such devices as the sander, the use of steam would, of course, be impossible. The other devices, however, or a large number of them, at least, would do as well with steam for their operation as they do with air.

Another means of overcoming the difficulty mentioned would be to supply engines with a second air pump, whose duty would be to deliver pressure to a reservoir separate from the air brake system, and thus independently supply the "parasites." Still another means would be to use a larger pump than is now used on engines, pumping into the main reservoir of the air brake system, then reducing out of that to a second and separate reservoir for the "parasites." This would be similar to the arrangement of the water-raising system on sleeping cars. The first mentioned remedy would undoubtedly be preferable, inasmuch that the "parasites" would be independent of, and isolated from, the air brake system, which it could not interfere with as it does at the present time. Possibly an attachment might be made to send the over-supply of the "parasite" reservoir to the main reservoir of the air brake system, thus aiding and assisting the air brake system, instead of interfering with it and taking from it, as at the present time.

The seriousness of the situation seems to be sufficient to warrant some such a scheme for relief. Even at the present time, with the above named devices or "parasites" in operation the air pump is frequently overtaxed in supplying the train pipe leakage of the train, leaving very little pressure to be diverted for the use of the "parasites." In the future we may expect to see additional pneumatically operated devices such as reversing gear, throttle opener, whistle operator, oil distributor and smoke consumer for the locomotive, and window hoists, seat turners and ventilating fans, etc., for the coaches, to say nothing of possible coupling and buffing devices operated by compressed air. With the experience of the past, the conditions of the present and the possibilities of the future, some disposal of this extra work on the air brake pump should be made, else complications will surely arise, and, at a critical moment, may seriously interfere with the operation of that great safety device, the air brake, ending possibly in disaster.

The Power of Public Speaking.

The class from which master car builders and master mechanics are drawn, lead such a busy life in devoting themselves to mechanical duties that they have very few opportunities for the study or practice of oratory; and accordingly we find that many men possessing commanding ideas on all questions relating to railroad machinery are incapable of explaining their views in a public meeting. When a man who labors under this disability becomes the head of his department, the inability to express his views consecutively in public is a decided source of weakness, for the modern railroad manager has come to expect that the head of his mechanical department will represent the company in public meetings and make his voice felt in advocacy of the policy favored for the road he serves.

The powerful influence exercised by good public speakers has been strikingly shown in certain work done by the Master Car Builders' Association. A good many years ago the Pennsylvania Railroad Company began using the Janney coupler, and a few years' trial convinced the officials of that great railroad system that the principle of close coupling on a vertical plane was the best form that could be adopted by the railroad companies of the country; and they proceeded to proselytize with the view of convincing others that the Janney form was the best coupler for general adoption. It was necessary to convince the majority of the members of the Master Car Builders' Association that the link and pin coupler, which most of them used and were satisfied with, was an antiquated device which had passed its days of usefulness, and that it must be abandoned and the vertical plane coupler introduced in its place. It was well known that a battle royal must be fought and won before the Pennsylvania Railroad interests could induce all the other railroad companies of the country to change from the link and pin coupler; and they proceeded skilfully to organize their forces. They stopped sending the practical car builders as their representatives to the Master Car Builders' convention and sent in their place educated mechanical engineers, such as R. H. Soule, E. H. Wall, and John W. Cloud and others, who were as ready in debate as they were capable of explaining the details of a car coupler. By their skill as debaters and by their ability in manipulating votes, these men carried a vote in favor of the vertical plane type of coupler when three-fourths of the members voting were against the type. The expression "vertical plane coupler" had not become common, and most of the members had no idea what it meant, when one of the Pennsylvania trio arose and moved a resolution that "it is the sense of this convention that the vertical plane type ought to be the standard coupler adopted by the railroads of this country." Some of the strongest opponents of the Janney type of coupler, F. D. Adams, for instance, supported the resolution without knowing that they were striking the death blow to their favorite link and pin coupler. When the majority realized what the vote meant, they made an effort to have it reconsidered, but the Pennsylvania men, by skilful parliamentary tactics, prevented that from being done. That was a powerful beginning of the educating process which led eventually to the adoption of the vertical plane coupler as a standard of the Master Car Builders' Association. It was a great tribute to what the power of alluring argument can do.

The necessity for railroad officials being able publicly to hold their own in an argument is much more pressing to-day than it was fifteen years ago, and the men who aspire to reach the head of the mechanical department ought to work as diligently to acquire the accomplishment of speaking in public as in learning about the mechanical details and the principles of caring for and operating railroad machinery. We have known of several cases lately where deserving men were passed over when their promotion was under consideration for the sole reason that the managements did not think that they were capable of representing satisfactorily the interests of the company in public meetings. The railroad clubs now constitute an excellent school of practice for those who are ambitious to learn how to express themselves in public. To the novice we

would say, do not attempt to make a speech at first. Get in the way of hearing your voice by making or recording motions and then acquire the practice of saying a few words on questions you are well acquainted with. The ordinary man will at first forget most of what he intended to say when he gets on his feet and sees the people looking at him; but that is the effect of natural timidity, which will soon disappear under persistent practice. Some of the most fluent speakers now heard at conventions and at club meetings began only a few years ago with timid flights of oratory, which seldom lasted half a minute, but persistent practice developed their natural talents for lucid expression. To most men the ability to speak in public must be acquired, but it constitutes a power worth laboring for.

A Railroad President on Compound Locomotives.

The president of one of our leading railroads in the course of a conversation with the writer a few weeks ago asked the question, What has been done in recent construction of locomotives to reduce the cost of moving freight? We answered by describing a few examples of the increased capacity of locomotives built within the last year and ventured to express the opinion that compounding was steadily reducing the quantity of coal required for moving the ton unit, and that locomotive designers had no reason to think that they were falling behind in the race of engineering progress. The question was then asked, Do you think that a compound locomotive moves freight at less expense than a simple engine? The answer was, It burns less coal. Then this president, who exercises very great authority and is a close observer of every detail of railroad operating, proceeded to denounce compound locomotives in the most vigorous terms. He did not regard the saving of a few pounds of coal per train mile as being of any consequence, compared with regularity of service, and he knew that compound locomotives spent much more time undergoing repairs than those of simple build. On that account he would have no more compound locomotives built for his system. When a compound locomotive missed a trip undergoing repairs and when it failed on the road, both of which events happened frequently, he said, the loss to the company was greater than a gain from coal saving would amount to in a year. But one case of missing a trip and one case of failure on the road were not incidents of rare occurrence, they were happening every week, and he was determined to stop that cause of the demoralizing of train service.

We are sorry to say that this official is not alone in his views of compound locomotives, and the objection always raised is that these engines are not so reliable for every-day service as simple engines. The compound locomotive has made remarkably rapid progress into service in the last ten years, but much of the influence that forced them into use came from above. The men immediately in charge of motive power were inclined to move slowly in making changes. They wished to see the compound prove itself a better and more acceptable engine under the ordeal of hard service than the single expansion type, before they introduced it in large numbers; but their conservative instincts were often overruled by the higher powers, and compounds were introduced where they were not wanted by the men best able to judge of their utility. The railroad president whose views we are writing about, is not a man of silence or one likely to restrain the expression of his views. These will be heard by other presidents through no uncertain tone. If the friends of compound locomotives wish to see their favorite medium of motive power prosper, they had better devote themselves with vigorous energy to the overcoming of the weaknesses which prevent compounds from making the same mileage per month as simple engines.

A Transportation Paradox.

"The best thing that could happen to every railway in the United States—or elsewhere, for that matter—would be to have a waterway paralleling every mile of its track, and the deeper the waterway within reasonable limits the greater would be the benefit derived by the railway." So says Mr. S. A. Thompson in an article in the July number of the *Engineering Magazine.* This appears to be a somewhat extravagant statement, but the author cites some remarkable instances where the increased business of the waterway seems to have a very direct bearing upon the prosperity of the railway. He tells us that during the fifteen years in which the channel of the River Elbe, in Bohemia, was being deepened, the river traffic increased fivefold, while the traffic of the competing railways increased still more largely. Again, it appears that in Germany after the River Main, between Frankfort and Mayence, had been converted into a canal, the tonnage of water borne freight grew 36 per cent. the first year and 58 the second, while the railroads along that stream in the same years increased their business 64 and 42 per cent.

Other examples are given, but the argument that waterways, by increasing traffic, are rather auxiliaries than competitors of railroads, is based upon the fact that water transportation is cheaper than that by rail, and that, therefore, it facilitates the shipment of raw materials and thus encourages manufacturing, and so furnishes a higher grade of freight and more of it for the railroads. When the canal is treated as an antagonist of the railroad and war is declared, it is likely to bring about a very serious loss to the railway, as was shown some years ago, when an investigation by the directors of the Great Western Railway of England disclosed the fact that the manager, who was trying to put the canal out of business, was using 58 per cent. of the total equipment in a traffic which produced only 14 per cent. of the total revenue. Traffic carried expensively when a more economical method is available brings about a loss to the community at large as well as to the company using the expensive method.

Mr. Thompson makes out a very good case for the canal as the handmaid of the railway, with its comparatively slow but cheap transportation of raw materials and rough freight in bulk, which, when manufactured, or employed in the arts, places the finished product in the hands of the railways, where its enhanced value demands more rapid transportation at consequently higher rates.

Having reasoned his way satisfactorily to this point, the author goes on, we think, a step too far, when he says: "If by some cataclysm of nature the Great Lakes should be dried up the enormous traffic now carried on their waters would not be divided among the railroads. It would simply cease to exist."

In other words, if a cheap and satisfactory street car system of transportation between a suburb and a large city was suddenly to be destroyed, nobody from the suburb would ever go to the city again.

Water transportation and rail transportation each have their legitimate fields, but to assert that one holds permanently what the other can under no circumstances ever possess, seems to go a trifle beyond what a careful study of the facts reveals.

Electric Drives for Shops.

In the installation of electric drives in railroad shops we have arrived at a point where a pause, in the selection of some details, should intervene long enough to make a proper choice of the best method of transmitting power to the tools to meet the requirements of the situation. The need for this is quite apparent to all who have had the opportunity of seeing what has been done in the revolutionizing of shop drives by means of electricity.

Shall shafting be used, and to what extent? This is one of the questions that will confront the inquirer into the merits and advantages of this kind of power. Here, as in other mechanical propositions, the size of the plant and character

of the output are the factors to deal with, and before a decision is made as to whether the power shall be transmitted to the tools singly or in groups, some consideration must of necessity be given to every phase of operation—whether the work is of an intermittent kind and what the effect of a break-down in the motor would be, on each tool with either system of drive, also the relative first cost, cost of maintenance and cost of output. These are recounted as a few of the points that are sure to present themselves, and there is no doubt some reliable data available at this time concerning these probems, which may assist in their solution, even though electricity for shop power is yet practically in an experimental state.

The kind of drive for heavy tools, both wood-working and for metal, is pretty well settled upon, as the direct method, that is, the many cases in which that system has had a fair trial would seem to indicate this to be a fact. There is no reason to take exception to this proposition as far as it relates to heavy tools where speed is constant and service continuous. It also holds in case of metal-working tools which demand a variable speed arrangement, the speed changes being accomplished by means of variable voltage. The latter case is not, however, as sure of its position as the former, from the fact of its not having had a trial of sufficient severity to develop any weaknesses that may be inherent in a system, necessarily complicated. In any event, the general efficiency and flexibility of the electric drive is now so well understood that no shop plant can be said to be "up to date" mechanically, that is not arranged with electrically driven tools. This is not all. While the power for tools is one of the questions of prime importance in shop economy, the very wide field opened up for electricity in other directions about the shop, for cranes, transfer tables, light, etc., make it practically indispensable in thoroughly efficient shop management.

Experience Counts.

If an ordinarily bright man were put on the engine pulling the Empire State Express, under instruction he would learn to handle the engine as well as an experienced engineer. But his work would be satisfactory only as long as everything went all right. He would possess none of the equipment that enables an engineer of mature experience when an emergency is staring him in the face to do the right thing to avert disaster before the mind has time to think of what ought to be done. Habit and training become more useful than reason. The reason high-speed automobilists meet so often with disaster is that they have not gone through the experiences which make action precede reasoning.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters in the waste basket.

(147) W. K., Victoria, Australia, asks what position would release cocks be in when steam is shut off when engine is drifting for 30 or 40 miles, at about 25 miles per hour—open or shut—and what about lubrication? The engine referred to is a Vauclain, four-cylinder compound goods engine, with low pressure cylinder on top. A.—The engine should be run with cylinder cocks open, and lubricator feeding. If possible on the more level places, on down grades, it would be well to work a little steam, not enough to accelerate the speed, but to give a vehicle for the distribution of the oil which flows in from the lubricator. Light working of steam also prevents the sucking of smoke into the exhaust passages.

(148) E. C. C., Du Bois, Pa., writes:

How can one locate a blow, and determine whether it is through piston packing or through the piston valve? Which side is it on, and if the valve, which end is the blow at? The engine in question is simple, with internal admission piston valve. A.—The blow, through the valve, is a continuous blow. The side may be determined by opening the smoke box door, if the exhaust has a double tip. If the exhaust is single it is very difficult to distinguish the side. It is of no practical importance to determine at which end the piston valve blows, that will be discovered when the proper valve has been removed for repairs. The blow through piston packing is intermittent; the side it is on may be found by the use of the cylinder cocks.

(149) F. J. H., Indianapolis, Ind., says:

(1.) I would like to ask what is meant by a "lap order?" A.—A lap order is the usual railroad name given to a crossing order in which, by mistake, the dispatcher directs a train moving down the alphabet, to cross, at say, station M, a train moving up the alphabet; and at the same time orders a train moving up the alphabet to cross the down train at station L. If both obey the orders they have received, they will collide at some point between stations M and L.

2. How many pints of valve oil does an ordinary lubricator hold? A.—A No. 2 lubricator holds about three pints.

(150) J. A. H., Pine Bluff, Ark., says he has an old style Monitor injector which used to work at 200 lbs. pressure, but now works at only 160 lbs., and then works very poorly, most of the water and steam going out of the overflow. If while working badly the frost plug is screwed down, the injector will work all right. What is the trouble? A.—The so-called frost plug is, of course, the waste valve. The injector may be more or less coated with lime or other deposit in the interior or the delivery tube may be very much worn.

(151) R. J. S. asks what is the proper way to test for a broken valve strip or spring, and how can one tell on which side the break is? A.—This cannot be satisfactorily tested in the shop with the engine standing still. A very good way to find out where the trouble lies is when running. The blowing valve will have lost a great deal of its balance, and may be found by the investigator if he walks out on the running board and grasps first one valve rod in his hand, and then the other. The one with the blowing valve attached, will indicate it by dragging more than the other. The experimenter will notice a difference in the "feel" of the two rods, in the way they are working.

(152) J. S., Milan, Mo., writes:

We have a piston valve, 20x26-in. engine, with direct motion. When we shut off and drop the lever down to the corner, she kicks and pounds, but if we hook her up to half stroke she goes along smoothly. What is the cause of this? A.—This may be due to different causes, and careful inspection would alone reveal the real reason. (1) Compare the travel of the valves in full gear with the throw of the eccentrics, and the distance between the connection of the eccentric rods to the expansion link, with the total travel of the link-block in the slot. Such comparison may show that the expansion link reaches too great an angle with the vertical center line to produce the best results. Note if there is any tendency to cutting between the link and block.

(2) Is the valve driven by a rod in the center, or on one side?

(3) Is there any indication of dryness in the valve when running shut off

(4) Is there any signs of wear in the valve bush, in the center of the travel?

(153) J. F., Litchfield, Ill., writes:

Given the draw bar pull or tractive power of a locomotive with 20x28-inch cylinders, to be 34,000 lbs., kindly give formula to find rating in tons of this sized locomotive on road with one per cent. grade. A.—Minimum resistance due to friction at about 6 miles per hour, 6¼ lbs. per ton. Resistance due to gravity (1 per cent. of weight), 20 lbs. per ton. Total resistance per ton on 1 per cent. grade, 26¼ lbs. Then

$$\frac{34{,}000}{26\frac{1}{4}} = 1{,}295 \text{ tons gross weight of train.}$$

The Cleveland Pneumatic Tool Company, Cleveland, Ohio, have purchased a tract of land on Hawthorne and Second avenues, and will at once begin the erection of modern factory buildings.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Yard Test of Triple Valves.

A special valve for use in connection with the yard test of triple valves is shown in Figure 1. It is so designed that, regardless of the length of train, or amount of leakage, the rise of train-pipe pressure is always at a predetermined number of pounds per minute. This rise corresponds to the conditions existing at the end of a long air train when a release is made, if the usual main reservoir pressure and a main reservoir of recommended capacity be employed.

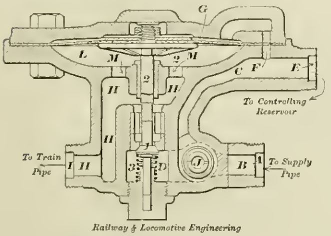


Fig. 1.—VALVE FOR TRIPLE VALVE TESTING DEVICE.

Operation of Device. As air from the yard plant or engine enters the valve at *A* (Fig. 1), it is free to pass through port *B* into chamber *D*. Train-pipe pressure can always be maintained in chamber *L* under diaphragm 2 by means of ports *H* and *M*. Air in port *B* is free to pass through small pin hole *J*, thence through port *C*, and out at *E* to the controlling reservoir. Owing to the unchanging volume of the controlling reservoir, a constant predetermined rise of pressure is obtained, and this pressure is always free to reach chamber *G*. When the pressure in this chamber is greater than that in chamber *L*, connected with the train pipe through ports *M* and *H*, diaphragm 2 is forced downward, thus unseating valve 1 and establishing a direct connection from the supply pipe to the train pipe through *A*, *B*, *D*, *H* and *I*. With a long train, valve 1 is forced farther from its seat, thus permitting a faster feed, while with one car the valve is barely off its seat; hence, regardless of the length of train, or the amount of leakage, this valve will cause a rise in train-pipe pressure of a predetermined number of pounds per minute, which feed is governed by the size of the controlling reservoir and of port *J*.

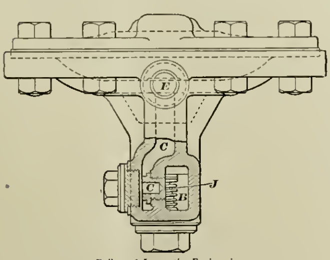


Fig. 1a.—VALVE FOR TRIPLE VALVE TESTING DEVICE.

Yard Test. The device illustrated in Fig. 2 is for use in connection with a yard-testing plant. It may also be used between the tender and first car of a train when an engine is to be used for testing same. The object of this apparatus is to condemn from road service to the cleaners any valve which will not release a brake when the rise in train-pipe pressure corresponds with that at the end of a long air train; controlling valve *N* accomplishes this result.

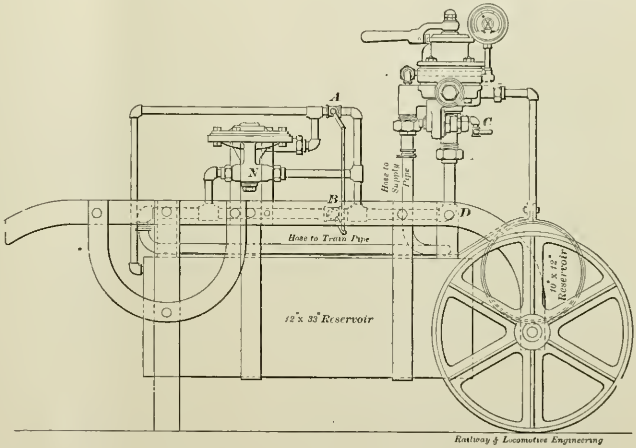


Fig. 2.—TRIPLE VALVE TESTING DEVICE MOUNTED.

If this device is always to be used in connection with an engine for testing trains, the brake valve and equalizing reservoir are unnecessary. In the event of the brake valve not being used, the supply pipe should be joined to the test apparatus at point *D*.

Test. To use with a yard-testing plant, connect hose as indicated and turn cocks *A* and *B* as shown. Cock *C* should always remain open when the yard-test plant is being used. The air now feeds through the brake valve, and the usual tests to locate leakage, faulty piston travel, triple valve, etc., should be made. When this has been completed and the train is fully charged to 70 pounds, make a service reduction of 10 pounds; then turn cocks *A* and *B* to their closed position and release. Any triple valve which fails to release the brake when the train-pipe pressure has reached 70 pounds should be removed, sent to the cleaners, and be replaced by a triple that has been cleaned.

If an engine is used to test brakes, the supply pipe of the testing device should be coupled to the train pipe or the tender and the other hose to the car. In this case cock *C* should remain closed throughout the test and the brake valve handle be left in full release position; otherwise the manipulation of the cocks is the same as just described in connection with a yard-testing plant.

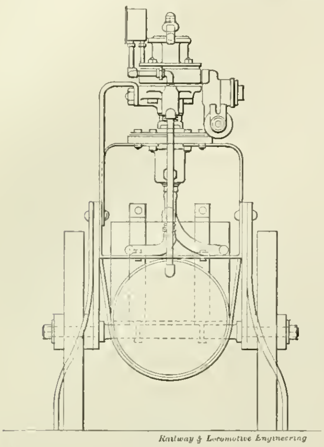
To avoid the escape of air, when the brake valve handle is in full release position, the warning port in the rotary valve should be plugged.

If always to be used between a tender and train and never with a yard-testing plant, omit the brake valve and equalizing reservoir and pipe as already explained. The manipulation of the cocks is the same as with the yard-testing plant. The disposal of any triple valve failing to release when the train-pipe pressure has reached 70 pounds should be as already explained.

In making the release test from an engine the engineer should keep the train-pipe pressure as near 80 pounds as possible by leaving the brake-valve handle in full release position as much as is necessary to accomplish this result.

Driving Wheel Brake Location.

We have a letter from a correspondent in which he justly criticises the brake cylinder location on some locomotives which is decidedly objectionable, inasmuch that such faulty location prohibits the ordinary inspection and maintenance,



END VIEW OF TRIPLE VALVE TESTING DEVICE.

and is likely to cause serious trouble by the failure of these cylinders to do their share of the work.

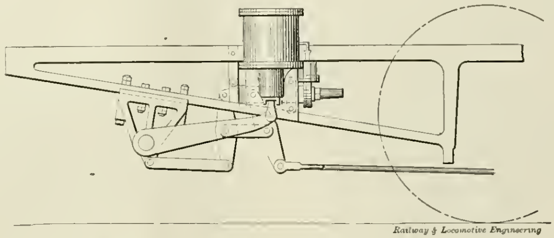
The prime complaint is of the locating of the brake cylinders in a horizontal position between the frames, immediately back of the cylinder saddle. This horizontal position is not as desirable as the vertical position, inasmuch that the leather packing rubs on the bottom of the cylinder, due to gravity, and thereby tends to wear away the bottom portion of the leather. The vertical position would correct this and permit the packing to wear evenly on all sides of the cylinder.

Perhaps the greatest objection is that the packing leathers are subjected to as great heat from the steam passing through the cylinder saddles as they would be were the cylinders in their old position on the frames at the side of the fire-box. The continued use of steam on a long run would send as much heat into the brake cylinders located back of and close to the saddle as would the fire-box with the old location of cylinders. In the location above mentioned there is no opportunity for partial cooling by the circulation of atmospheric air, which is a disadvantageous feature as compared with the position of the driving brake cylinders on the side of the fire-box. It would seem highly desirable to earnestly urge a change in the location of these cylinders, setting them further back from the cylinder saddle and giving them a vertical position, taking care that the top head of the cylinder shall not be too close to the bottom of the boiler, thereby preventing the removal of the pressure head for inspection and repairs of the interior parts.

This is a matter which should be taken up at once and corrected, if we are to obtain anything like a maximum service from our driving-wheel brakes.

As to Abolishing the Quick Action Feature.

In regard to the suggestion to abolish the quick action feature of the triple valve, as recommended by a correspondent in a recent number, it would



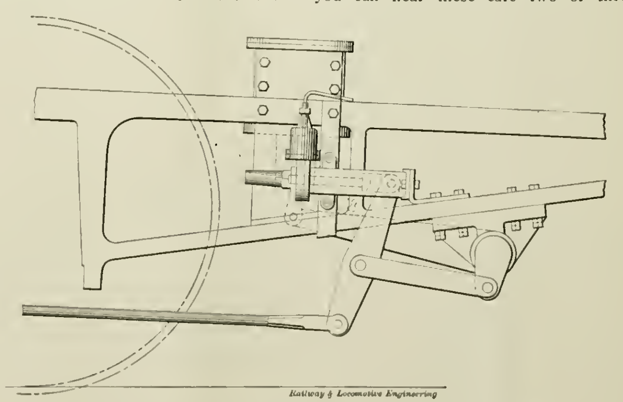
ARRANGEMENT OF SLACK ADJUSTER FOR DRIVER BRAKES.

seem hardly necessary to say that this suggestion is not in line with good modern practice. The peculiar needs of long freight trains in service some time ago demonstrated the necessity for a brake which would apply very quickly for in case of emergency, thereby reducing the length of the stop in emergency, and not interfering with the service feature of the brake in service stops. The extensive tests held by the master car builders on the Burlington road in 1886 and 1887 demonstrated the necessity for a brake of this kind, and after careful consideration and extensive experiments, the present form of quick acting brake was adopted by the master car builders and the railroads of the United States, and it has been in satisfactory service ever since.

If such difficulty as cited by the above mentioned correspondent is experienced from the air brake on railroads, it is doubtless due to either the bad order of the brakes, flagrant misuse of the brakes, or something else of a kindred nature. It is not due to the quick action principle involved. It would probably repay this correspondent, for his own information, to read up the history of the development of the quick acting brake; he will certainly be very much benefited thereby. He will also, doubtless, change his views as to the desirability of abolishing the quick action feature of the triple valve, and will become an earnest convert of the device.

Didn't Know a Flat Wheel When He Heard It.

Some of the cars that run on Thirty-fourth street, writes a "kicker" in the New York *Sun* who signs himself "Indignant," are an absolute infliction. When a car is in motion incessant pounding begins and continues with the regularity of the ticking of a watch. I have often been kept awake at night by this nuisance, for you can hear these cars two or three blocks away as they come thumping down the street, clouds of dust following in their wake. Can nothing be done by the people living on Thirty-fourth street to abate this nuisance?



NEW DESIGN OF SLACK ADJUSTER FOR DRIVER BRAKES.

CORRESPONDENCE.

Air Pump Piping and Main Reservoir Location.

Figure 1 of the attached sketches shows the piping on several eastern engines. It is quite evident at a glance that those who detailed this arrangement of pump piping knew little of air. Notice how nicely they fit the piping to the fire box, to keep it from freezing, somebody thought, and notice, too, a dip is shown at *a*. This is the most foolish business of piping that has ever come to my notice. Think of the frozen brakes next winter!

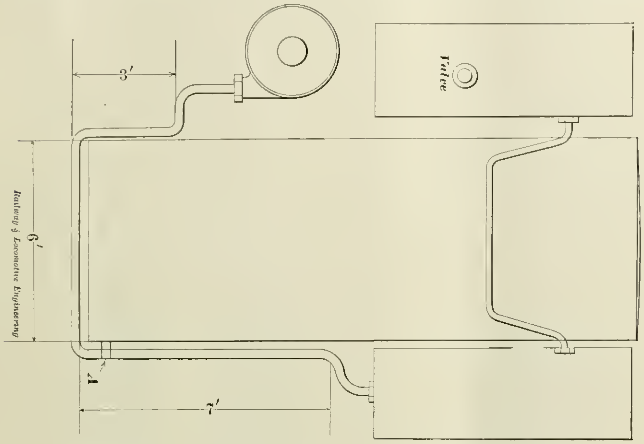


Fig. 1.—FAULTY DESIGN OF COOLING PIPE AND LOCATION FOR MAIN RESERVOIRS.

Figure 2 shows detail of piping that is believed to beat any yet noticed. Both reservoirs are on the same side, with 20 or 30 feet of pipe between the pump and the first reservoir, and is arranged with returns. At *b* is shown a water trap, and the details are shown in Fig. 3.

FRANK RATTEK.

Manchester, N. H.

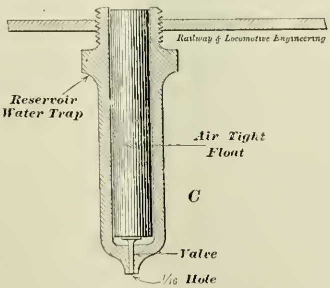


Fig. 3.—WATER TRAP FOR MAIN RESERVOIRS.

Objection to Abolishing Quick Action Feature of Triple Valve.

With reference to the suggestion in the June issue to abolish the quick action feature on account of hose bursting, I think the writer will not find many to agree with him. When we used to use the old style of pin and link drawbar, there was a lot of slack in a 50 or 60-car train; and if a hose burst on a train of this kind only partly equipped with air, it would often drive the drawbars in and sometimes throw the cars at the rear end off the track. But now, as the cars are all equipped with the automatic drawbars, and as the trains are generally from ¾ to ⅞ air cars, the bursting of a hose does not any more than upset the teapot on the stove in the caboose, and maybe disturb the conductor's sleep.

Now, we will take a train of say 65 or 70 freight cars, and 45 or 50 of them equipped with air, running 30 or 35 miles per hour. The engineer is suddenly flagged, or on rounding a curve the rear end of the sleeper of a passenger train suddenly looms up, and the engineer places the handle of the engineer's valve in emergency position (which he would do in this case). If the quick action feature of the triple valves were blocked, we can form an idea of the damage that would be done to the train, even if the engine did not crash into the sleeper and kill a lot of people, which might have been avoided had not the extra braking power been lost by the blocking up the quick action feature of the triple valves. Lots of collisions have been saved by the extra braking power that is got by using the quick action triples. What is a few drawbars drove in or broken, or a car or two thrown off the track to two engines broken up, or an engine and a sleeping car ruined, and a lot of lives lost?

Mr. O'Hara says as we are becoming more fully equipped with air brakes the more hose we have, and the more chances there are of bursting them. That is very true, but the more air cars, the less non-air cars, and consequently the less damage will be done by the hose bursting. Abolishing quick action seems to me to be like going back from the plain triple to the old straight air with only a train pipe and brake cylinder. GEO. E. CROWSON.

Moncton, N. B., Canada.

Proof of the Pudding is the Eating.

In reference to Mr. A. J. O'Hara's suggestion in June number to abolish the quick action part of triple valve, on account of the danger of derailing the rear part of train in case of an air hose bursting, I would like to say that here on the Northern Pacific Ry., where we have nearly all air, such an accident is an unheard of thing. I would consider it a much better idea to equip all cars with up-to-date air brakes, which I think would do away with any such danger.

The quick action feature of the triple valve has, in my experience, saved more than one life, considerable property and no doubt some men's jobs, and I would certainly consider its removal a long step backward.

We have no serious trouble in handling a solid air brake train of 75 cars on ordinary grades with one 9½-inch pump. However, his suggestion of a larger or additional pump would be a very good thing when handling very long trains on mountain grades.

J. A. B., Engineer Nor. Pac. Ry.

Logan, Mont.

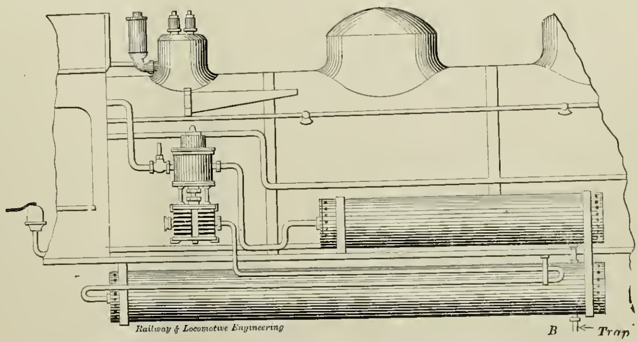
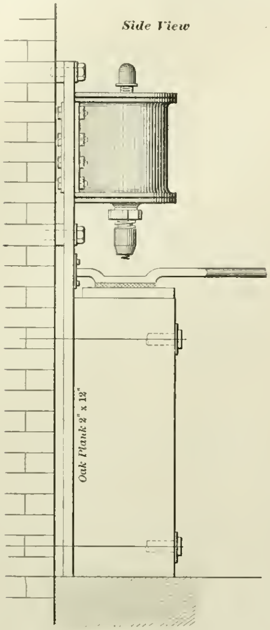


Fig. 2.—PROPOSED COOLING PIPE AND MAIN RESERVOIR LOCATION.

Cutters for Making Gaskets From Old Air-Brake Hose.

Thinking that you may be interested in our method of utilizing scrap air-brake hose, as has been our practice for several years, by cutting them into gaskets for packing throttle stems, valve stems, etc., of locomotives, I send you sketch of the tools used for cutting the gaskets from scrap air-brake hose. These gaskets cost only a trifle and are superior to those purchased in the market for packing purposes.



DEVICE FOR CUTTING GASKETS FROM OLD HOSE.

E. A. Miller, M.M.
Nickle Plate R. R., Conneaut, O.

Duplex Retaining Valve.

I am sending to you a drawing and description of a duplex retaining valve, for which I have recently secured a patent. I would be pleased to have you publish the inclosed, which I think would interest many brother engineers, especially those who are handling trains on mountain grades, which I have done for the past six years on the Montana Central Division of the Great Northern Ry., between Helena and Butte, Mont.

The difficulties and dangers attending the operation and control of trains upon steep and mountainous grades, whatever be the relative arrangement of the cars comprising the train, are well known to practical railroad men and need not be herein recited. The use of my invention will wholly eliminate such difficulties and dangers, as it provides means for retaining such pressure within the brake cylinders as will control the individual car according to its weight or weight and load.

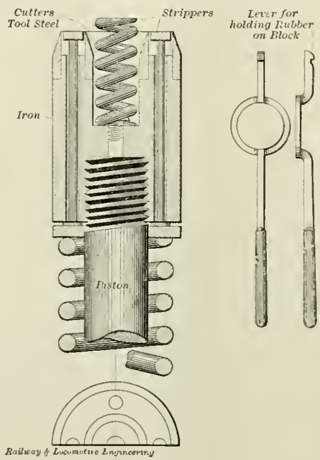
The object of my pressure-retaining valve is the provision of means for retaining limited pressures within the brake cylinders when the engineer recharges the auxiliary reservoirs, said pressures corresponding to the weights of the individual cars comprising the train.

Fig. 1 is a sectional view of the duplex retaining valve with the handle in position of full release.

Fig. 2 shows the handle in the position it occupies when a relatively low pressure is retained within the brake cylinder.

Fig. 3 shows the position of the handle when a relatively high pressure is retained in the brake cylinder.

The springs determine the pressure retained, which may vary from 10, 15 or 20 pounds for the lighter cars up to approximately full or completely full pressure for the heavier cars.



DETAILS OF CUTTER.

In my valve construction modifications may be introduced and equivalents used for parts of the valve; for instance, I may substitute weighted valves for the valves and springs shown, and the parts may be differently disposed, changes which will not affect the modes of operation to secure the desired results.

John A. Toal.
Clancy, Mont.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(170) E. B. E., Newark, O., asks:

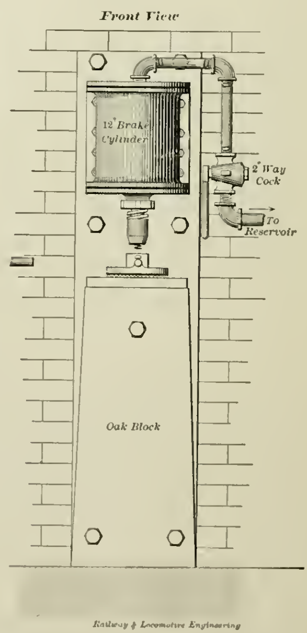
With the same brake pressure upon the shoe, what effect will a higher speed have on brake shoe friction? A.—The friction between the brake shoe and the wheel, which is termed coefficient of friction, reduces as the speed of the train increases.

(171) J. M. E., Buffalo, N. Y., writes:

The New York Air Brake Company's train pipe strainers on some coal cars here are placed in a slanting position; that is, they do not stand straight and square. Is there any harm in this? A.—A slight deviation from an upright position of the strainer will not interfere with its proper operation. The strainer, however, should be given a position as nearly upright as possible, as it does its best work in this position.

(172) E. B. E., Newark, O., writes:

So long as wheels do not slide, where is the holding power of the brake? A.—The greatest retarding power exerted by the brake shoe is at the time of impending slip; that is, just before it begins to skid. After the wheels have begun to slip, the retarding power is greatly reduced. For convenience we might say that the rail is pulling backward on the wheel, keeping it revolving, and the brake shoe is pulling in the opposite direction, tending to stop its rotation. As soon as the brake shoe pull becomes greater than the pull of the rail, the wheel will cease to revolve, will slide, and will not hold nearly as much as when the wheel is rolling along on the rail with the brake shoe threatening to stop the rotation.



DEVICE FOR CUTTING GASKETS FROM OLD HOSE.

(173) G. E. C., Moncton, N. B., Canada, writes:

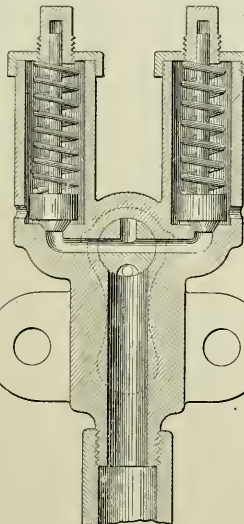
Can the brakes on a 60-car train be released one at a time, beginning at the first car, next to the engine, by making a

quick movement of the handle of the engineer's brake valve from lap to running or full release position and back again? Is it not mere chance work on a train of any length? A.—It is the merest chance work, and would be next to impossible to accomplish. If all triple valves were exactly and uniformly fitted, in the same condition and all brake pistons traveled the same stroke, such an operation might be possible. However, with even these conditions existing, the chances would be very greatly against getting such results, and would be almost absolutely impossible.

(174) G. E. W., Fort Worth, Tex., writes:

How long will it take to charge a train

Fig. 1



Railway & Locomotive Engineering

Fig. 2

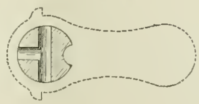
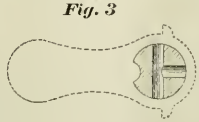


Fig. 3



DUPLEX RETAINING VALVE.

of thirty cars to 70 lbs., after the engine is coupled to the train, with 90 lbs. in main reservoir to start with? No leaks. Nine and one-half inch pump in first-class condition. A.—If the pressure in the train pipe at the triple valve on each car were maintained at 90 lbs., each auxiliary reservoir would probably receive its full charge from zero to 90 lbs. in about two minutes or thereabouts. However, if it were not possible to maintain 90 lbs. at each triple, the time of charging would be considerably lengthened, depending upon the variation of pressure at the triple valve. Leakage in the train pipe would also have its effect in increasing the length of time of charging, and would vary with the degree of leakage in the train pipe, large leaks causing slower charge.

(175) C. E. B., Port Casta, Cal., asks:

What would be the effect if the graduating valve were lost or removed from a driving brake triple valve? A.—If the triple was nicely fitted, in good repair and well cleaned and oiled, the absence of a graduating valve might not be felt on a train of considerable length when a service application was made. However, if the train was very short, or the light engine was alone, the piston and slide valve might be able to graduate the auxiliary reservoir pressure into the brake cylinder without going to full stroke, but the chances would be against it. If the piston and slide valve were gummy, tightly fitted, or otherwise in poor condition, the piston and slide valve might pass to full stroke position in an automatic service application, causing a quick flow of auxiliary pressure to the brake cylinder, then the brake releasing. Again, it might not.

(176) O. H. L., Baltimore, Md., writes:

At the end of our run we cut the engine off the train and allow the train to run down to the roundhouse, and the engine goes on another track. Then the engine is turned and placed on the opposite end of the train. Sometimes the train will not run, due to the brake sticking. If the bleeder cock on the sticking car is opened and left open, the brakes will set on the whole train. Why is this? A.—The brake first sticking is probably due to the leakage of pressure from the train pipe, or failure to release the brakes fully before the engine is cut off when "swinging" the train. To bleed off a sticking brake in a case like this, the bleeder cock should be merely opened until the triple is heard to whistle off, then promptly closed. If, however, the bleeder cock is left open, the air is drained from the auxiliary reservoir, and pressure from the train pipe flows in through the triple valve to the auxiliary reservoir on this car to take the place of the air escaping through the cock. This train pipe pressure, feeding into the auxiliary reservoir on the sticking car, causes a reduction in the train pipe pressure of the other cars, thereby setting their brakes.

(177) J. B. B., Allen, Neb., asks:

Is not the excess pressure valve and the slide valve feed valve the same, or are they different? A.—The two valves are different. The excess pressure valve merely maintains a higher pressure in the main reservoir than in the train pipe, due to the tension of the spring in the valve. If the spring has a 20-lb. tension, the brake valve will carry 20 lbs. excess with the handle in running position. This 20-lb. excess, or 20 lbs. difference in main reservoir and train pipe pressures, will be the same at low and high pressures, and in fact, at any pressures. The slide valve feed valve attachment not only carries the excess pressure, but does not have excess pressure until after the standard train line pressure has been pumped up. Should there be any leakage in the train pipe system, the slide valve feed valve attachment will open up, feed these leaks and close the valve when the train line pressure has reached its maximum. Again, the slide valve feed valve opens up widely during its time of feed, thereby giving the fastest possible rate of feed until such time as the maximum pressure is reached, then it closes quickly.

(178) P. M. E., West Albany, N. Y., writes:

Some of our engines are equipped with 12-in. brake cylinders, arranged in a horizontal position, and are located directly back of the cylinder saddle of the engine. These cylinders are butted up against the cylinder saddle so closely that it is impossible to get off the cylinder head to work on the piston packing. We have been obliged to take several of these cylinders down, in order to clean them, and find the leather packing burned out. It seems to me that is as hot a place for the leather packing as we get by putting the brake cylinder on the side of the fire-box. What is your opinion regarding this? A.—The object originally sought by placing the driving brake cylinders forward, between the frames, was that they might be located in a cooler place, thereby securing a longer life to the packing leathers, greater tightness during operation, and convenience for cleaning. In the case above described these objects have not been at all met, and are fully as faulty in every respect as though the cylinders were located in their old position on the frames beside the fire-box. This location should certainly be changed, and another given the cylinders, which would bring about the results desired and originally sought.

Making the Locomotive a Better Steamer.

In the course of his address at the Master Mechanics' convention Mr. Waitt said:

"The tendency in locomotive design at present is toward a greatly reduced ratio of the grate surface and heating surface to the weight on drivers for engines burning bituminous coal, and it would appear, from the satisfactory results obtained from locomotives of recent design, that the former standards of good practice recommended by this association must be materially revised. It is an uncontroverted fact that greater attention is now being given the careful designing and proper proportioning of locomotives than ever before, and during the past three years the American locomotive has taken long strides ahead as a steam producer and speed maker.

"In past years failures to make steam in sufficient quantities to reliably handle heavy passenger trains at high speed have been rather frequent. This condition has developed the fact that there has been some error in the basis of design of locomotives for heavy or fast service. A little examination of the relation between the heating surface and the work expected from the locomotive will readily indicate the necessity for very different ratios than have been used in past years. It is a conceded fact that the weight on the driving wheels gives the limit to the power that can be exerted by a locomotive in handling a train. It is a known fact that engines designed ten years ago fail for lack of steam when assigned to haul at fast speed trains which they are abundantly able to start. It is known that locomotives designed during the past two years have overcome this difficulty, and make an abundance of steam, so that even with coal poorer in quality than ordinary, and with head winds, and an extra car or two, little difficulty is experienced in producing plenty of steam, and maintaining a fairly uniform pressure. Taking the weight on the drivers as an indicator of the power expected from the locomotive, and assuming a proper proportioning of the cylinder and diameter of drivers for the work to be performed, we must naturally look to the source of steam production, which is the boiler. The amount of steam produced, of course, depends upon the coal consumed (either economically or otherwise), and the evaporative efficiency of the boiler. Assuming a boiler of reasonably good design, the evaporative efficiency will be closely proportionate to the amount of effective heating surface provided to conduct the heat from the incandescent fire and hot gases to the water. An analysis of the vital proportions of engines that were considered marvels in their day, ten years ago, shows the ratio of heating surface in square feet to the weight on drivers in pounds as about 1 to 45 for passenger service. The once-famous 999 of the World's Fair period had the ratio of 1 to 43.5. Engines built with the same weight on drivers for heavy or fast passenger service during the past two years have this ratio 1 to 30.5. Though both are capable of starting trains of corresponding weight, the 1893 class fails in the long run, consumes more coal per unit of work performed, and as a consequence has been consigned to services without either honor or good record. The 1901 class, with the 1 to 30 ratio, and same driving wheel weight, does more work with less fuel, and with rare failures, and is naturally the idol of the hour. As a suggestion worthy of consideration, and the result of no small amount of observation and computation, let me recommend that in new locomotives designed for the best results under present conditions, that for passenger service, engines burning bituminous coal should have a ratio of heating surface to weight on drivers of not more than 1 to 30. Some of the best working locomotives now in service have this ratio as low as 1 to 27. For heavy freight service, where the speed in going over a division of from 100 to 150 miles averages from 15 to 20 miles per hour, the ratio should not exceed 1 to 50. For switching service, where demands for steam are less continuous, a ratio of 1 to 75 will produce excellent results.

New York to Chicago in Twenty Hours.

On June 15, 1902, a new fast express train service was inaugurated between New York and Chicago by both the New York Central and Hudson River and the Pennsylvania Railroad companies.

The new trains are known respectively as the "Twentieth Century Limited" and the "Pennsylvania Special," and are scheduled to cover the distance between the two cities in twenty hours, which time they have made every day since they went into service.

Our illustrations on the opposite page show these trains photographed when in rapid motion, the "Twentieth Century Limited" being drawn by one of the New York Central's new Atlantic type of engines, No. 2960, and the "Pennsylvania Special" by one of the Pennsylvania's class "L" engines, No. 1395.

The trains are composed of four cars each, all of which are Pullman equipment, except that a Pennsylvania Railroad dining car is used on the "Pennsylvania Special." These cars are fitted up in the most approved and luxurious style known to the car builders' art. They are lighted by electricity and are provided with electric fans to add to the passenger's comfort in hot summer weather.

The distance between New York and Chicago is 912 miles by the Pennsylvania, requiring their train to run at the rate of 45 3-5 miles per hour, exclusive of stops, and by the New York Central it is 980 miles, requiring their train to run at the rate of 49 miles per hour, exclusive of stops, but as the trains make certain regular stops and are subject to many slow-downs en route, it is necessary for them to run at a much higher rate of speed, and they often reach a 60-mile per hour speed in order to cover the distance within the schedule time.

It will be noticed that the distance by the Pennsylvania is 68 miles shorter than by the Central, but this is compensated for by the fact that the Pennsylvania train has some very heavy grade climbing to do in crossing the Allegheny Mountains, which materially reduces their rate of speed for a considerable distance.

There has already been one record run made by one of these trains, this occurred on June 30th, when the "Twentieth Century Limited" was considerably detained at Albany and the lost time had to be made up in order to take the train into Chicago on time. On this occasion the train ran from Albany to Syracuse, a distance of 148 miles, in 145 minutes, including several slow-downs and the regular stop at Utica.

The New York Central cars, which without the dining car weigh altogether 454,800 lbs., may be more particularly described as follows: The buffet library smoking car contains a smoking room, seating thirty persons, equipped with easy chairs, a library equipped with standard literature and all of the best periodicals, a completely appointed barber shop and bathroom, a writing desk with suitable stationery, and a buffet from which light refreshments are served. The dining car weighs 109,400 lbs., it has five double tables, seating four persons each, and five single tables, seating two each. These cars are very attractive, being finished in Santiago mahogany.

The sleeping cars contain twelve sections and a drawing-room and a stateroom, the rooms being connected by folding doors, so that they may be used separately or *en suite*. These cars are finished in vermillion wood and marquetry. The observation car has eight compartments, finished in mahogany. Circassian walnut, satinwood and prima vera. The large observation room is finished in vermilion wood and equipped with comfortable chairs and sofas and a writing desk. A large observation platform affords an exceptional opportunity for viewing the scenery.

TWENTIETH CENTURY LIMITED.
NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

Photos by F. W. Blauvelt, N. Y.

THE PENNSYLVANIA SPECIAL.
PENNSYLVANIA RAILROAD.

THE NEW FLYERS AT FULL SPEED, NEW YORK TO CHICAGO IN TWENTY HOURS.

M. M. Convention Notes.

The American Railway Master Mechanics' convention was held so late this year that we were unable to publish a report of the proceedings in our July issue, so we will have to make a belated apology in our present number. The convention opened with an unusually interesting and valuable address by President Waitt, which was followed by papers and discussions that maintained the high average which the proceedings of this association have attained.

A Year's Progress in Locomotive Building.

In his opening address before the Master Mechanics' convention President Waitt said:

"Statistics compiled for the year 1901 showed the total output of the eight principal locomotive building plants of this country as 3,384. This was the largest output on record, and is $7\frac{3}{10}$ per cent. more than in 1900. For the year ending June 1, 1902, the record of locomotive building has exceeded even the year 1901. The reports of five locomotive manufacturing companies indicating an output of 3,638, which is a total result beyond what has ever before been reached. Of these locomotives about 540 were for passenger service, 2,380 for freight service, and the balance for switching and miscellaneous uses; 80 per cent. were for use of bituminous coal; 10 per cent. for anthracite, and the balance, 10 per cent., for oil or other fuels. Of the bituminous coal burning standard-gauge engines, about 50 per cent. were constructed with so-called wide fire-boxes, extending beyond the outside of frames. During the past year about 30 per cent. of the total of passenger and freight engines built by the two largest locomotive manufacturing companies were of the compound type. The heaviest engine built during the past year weighed, not including the tender, 267,800 lbs., 237,800 lbs. of which were on the driving wheels. This was a locomotive of the decapod type, built for heavy service on the Atchison, Topeka & Santa Fe Ry.

"The past five years have shown a wonderful development in the main features of locomotive design and construction. No longer than 1897, passenger engines with 2,200 ft. of heating surface, and freight engines with 2,900 ft., were spoken of as marvels of progress, and comment was made at that time of the fact that boiler pressures were being raised to above 150 lbs., and might possibly reach 180 lbs., on simple locomotives. The past year engines have been constructed for passenger service with over 3,500 ft. of heating service, and freight engines with 5,390 ft. Most of the simple engines constructed carry 200 lbs. pressure and some have been designed for 225 lbs. At the present time it seems to be a conceded fact that with 200 lbs. pressure the economical limit for simple engines has been reached, and that for higher pressure the compounding feature is necessary for economy in fuel consumption.

"During the past two years the limitations of the two-cylinder compound engine have been reached and passed. The required dimensions for the low pressure cylinders for two-cylinder type on the heavy engines of recent construction exceed the possible clearance limits for side tracks and switch stands, and the space between the necessary location of the center of cylinder and top of rail. In the present state of the art two alternatives seem to be presented, namely, the tandem or the four-cylinder compounds, both of which types have enthusiastic adherents and ardent opponents.

Ton-Mile Statistics.

The ton-mile statistics committee in their report pointed out that the cost of operating was very seriously affected by the various conditions under which work may be done by a locomotive. The effect of grades was alluded to as follows: "Assume that 5 lbs. is the drawbar pull necessary to keep a ton of train in motion at a speed of eight miles per hour on a level track. The introduction of a grade as slight as one-fourth of one per cent., or 13.2 ft. per mile, doubles the resistance per ton, reducing the capacity of a given locomotive from one thousand to five hundred tons, and doubling the operating and motive power costs per ton-mile.

In dealing with what the committee called the "unit of statistics," it was stated that "Work is measured by the unit horse power, which is the power required to raise thirty-three thousand pounds one foot in one minute, and therefore contains the elements of weight, distance and rate of speed. The element distance, alone has until comparatively recently been used as the unit, as in the engine mile and train mile, which in reality are only units of distance, as the engine and train cannot be properly considered units because they have no fixed value. . . ."

"Assuming that we have the average pull and speed, no matter how obtained, these must be multiplied together, and the product by the distance through which the pull was exerted, and then divided by 33,000 to find the desired horse power. It is evident that the problem is a difficult and costly one to solve." The committee did not consider it advisable to introduce the "time" element into these statistics at present. They further said: "The ideal system of tonnage ratings would be one which would measure accurately the resistance a train will develop, regardless of the number of cars, load, empties or partly loaded cars it contains or their weight or capacity, as it is the resistance a locomotive is capable of overcoming which a tonnage rating should measure, rather than the number of cars or tons it is capable of hauling. Several systems of tonnage ratings which take into account the varying resistance of empty, loaded and partly loaded cars are in use which have resulted in more uniform trainloads and time between terminals, thus increasing the efficiency of the motive power and reducing costs."

"Theoretical considerations show and careful tests have proved that the resistance of a ton of empty cars compared with that of a ton of fully loaded cars, decreases with an increase of grade and increases as the speed increases. . . .

"In view of the facts presented, it seems best to use the actual rather than the adjusted tonnage for motive power statistics, until a practical method of determining the actual horse power developed by locomotives or a single system of adjusted tonnage ratings has been devised, satisfactorily tested and adopted."

"If the ton mile, either as ton miles per locomotive or cost per ton mile, is used as a basis for operating statistics, it will show the benefits of grade reduction, more powerful locomotives and larger capacity cars, both in increased ton mileage per locomotive and reduced cost per ton mile, as a little thought will show."

The committee was continued another year for the purpose of determining what is the proper credit for ton mileage for switching locomotives, and also to present the subject to the American Railway Association.

Electric Driving for Shops.

Mr. C. A. Seley, of Chicago, presented a paper on the subject named above. The argument for and against group driving for railway shop machinery as given, is briefly: One machine requiring 1 H. P. may be taken as a unit; individually motor driven, this machine would take a 1 H. P. motor to operate it, even if it ran but one-half the time, and average machine tools are idle or running light at least that amount, for work or tool adjustment. Two or three such tools grouped would not require their full multiple of the unit power, but the full value of grouped driving will be reached first, when the number of machines in the group will enable the use of a motor of sufficient size for a near approach to good electrical efficiency, which is not possible with small motors; and second, when the number of machines is such that the proportion of idle time may be so distributed over them as to be practically continuous and effect a proportionate reduction in the

power needed in the motor. For example, if one unit take 1 H. P., and is idle one-half the time, two such units can be driven by a 1 H. P. motor, provided the machines are run alternately, but if both are operated together the motor will be subjected to 100 per cent. overload.

On the other hand, many shops employ gear connections between their motors and machines, especially the modern heavy machinery, much of which is now built to be directly driven. Where the gearing can be covered and protected it may do very well, but wear is inevitable and gear breakages are expensive and at times exceedingly inconvenient. There is a very desirable flexibility in a belt connection, and if there should be a failure of the motor an extra one can be readily installed if standard types are employed. Some of the electrical companies have developed systems of multiple voltage, which, in connection with double or triple gearing, give a large range of adjustment of cutting speed of tools individually driven, enabling maximum output after proper speed has been determined by experiment. These systems involve the use of considerable gearing, additional wiring and a generating set arranged with reference to the number of the voltage desired.

Remarks on Electric Driving.

In the discussion on Electric Driving for Shops it was pointed out by Mr. Fowler that certain tests have been made in machine shops where it has been possible to make a comparison between the cost of driving by electricity and with the ordinary shaft methods. In both cases it has been found that there is comparatively little difference, and what difference there is, is in favor of the shafting; that, if it is a shop where all of the machines can be considered as one unit and driven from a line of shafting, it is cheaper to belt all the machines directly to the shafting than it is to put in an electric drive either in large or small units; but that is a comparatively insignificant factor in the total of shop expenses, and if the other savings which come in from the use of electric driving are taken into consideration, there can be no comparison whatever in the favor that would be shown to the electric method.

The treasurer of the association stated he had interested himself in the subject to some extent, as it has been developed, and was struck with the advantages got from the individual drive. He said: "When I was out West I talked to a master mechanic who is building new shops and who is about to introduce electrical power for driving machinery. I expressed the belief that individual method was better than grouping, but he favored the idea of grouping. He came into my office about a month afterwards, and said that he had gone into a shop of a well-known tool manufacturer and that they were using the group system. The foreman expressed the opinion that the group system was all right, that it was better than the individual system, and that there were fewer tools to look after. They went along to a place where there were five machines standing idle, and he found an accident had happened to the dynamo which was driving that group and the men were all standing idle waiting for the dynamo to be repaired. Now, that was what I call an object lesson, and illustrates the advantage of individual motors.

Up-to-Date Roundhouses.

In the report on roundhouses Mr. D. Van Alstine, superintendent of motive power of the Chicago Great Western Ry., summarized the requirements of what would constitute an ideal roundhouse as follows:

The ideal roundhouse is the one which handles engines with the least possible delay at the lowest possible cost. It provides in-bound tracks of sufficient length to store a large number of engines, on which are located coal chutes, sandhouse and cinder pits. The coal chutes consist of forty or fifty ton pockets on scales, into which hopper-bottom cars may be unloaded. The track above the pockets is reached by a 4 per cent. or 5 per cent. grade. At one end of the coal chute are the sand pockets, which are filled from cars the same as the coal pockets. After the sand is dried it is stored in elevated pockets, from which it is drawn into sand boxes. The cinder pits are 150 ft. long and depressed tracks about 8 ft. below bottom of cinder pits to allow of cheap loading of cinders into cinder cars. There should also be short cinder pits in out-bound tracks for cleaning ash pans of out-bound engines, and cleaning fires of switch engines. Stand pipes should furnish water to engines on in-bound and out-bound tracks. The turntable is 70 ft. long and operated by power. The roundhouse is 80 ft. long in the clear, with doors 12 ft. wide and 16 ft. high. It is heated by hot air from heater and fan, which passes around the house through an underground duct on the inside circle, and is distributed to pits through underground pipes. The air to be heated is not taken from inside the roundhouse. A hot well into which drained all the exhaust steam from the plant, as well as steam from engines blown off, furnishes hot water for washing out and filling up, and for stationary boilers. The power house boilers are arranged to burn front end cinders where the price of coal makes the burning of cinders profitable. The engine room is provided with engine, dynamos, wash-out pumps, fire pump and air compressors. The machine shop is provided with lathes, bolt cutter, drill press, shaper, grindstone, planer, screw press, blacksmith forge and anvil. The storeroom contains all necessary supplies, except oil, and a tool room for small tools. The engineer's room is located close to the roundhouse foreman's office and contains bulletin boards and desk. The roundhouse foreman's office is centrally located. The lavatory is provided with wash basins, shower baths, closets and lockers for engineers, firemen and roundhouse men. The oilhouse should be conveniently located for taking oil cans to and from engines. In the roundhouse are tool racks between pits for pinch bars, wrenches and heavy tools, work benches on outer wall supported by brackets, drop pits for engine truck and driving wheels. An overhead track for lifting smokestacks, smoke-box fronts, steam pipes, steam chests, pistons, cylinder heads, cross-heads, etc., electric lights, electric and air motors for cylinder boring, etc. The overhead track has trolleys and chain hoists. The drop pits have hydraulic jacks on carriages for raising, lowering and moving wheels. The rod man is provided with a work bench on wheels. A wheel storage yard is conveniently located for getting wheels into and out of the roundhouse. If fuel oil is used for fire kindling, a 6,000-gallon storage tank underground is located so that it can be filled from a tank car, and oil easily pumped from it for use in the roundhouse.

Details of Recent Roundhouse Construction.

Mr. G. M. Basford, in that portion of the report on up-to-date roundhouses, the preparation of which was assigned to him, has covered the ground very fully. Among other things he remarks on the subject of heating and ventilation. For good ventilation the volume of air required from the fan is much greater than is required to pass through the fan for heating alone. A good rule is to require the air to be renewed every eight or ten minutes. Practice in heating and ventilating is not by any means uniform, and an attempt has been made to secure information which shall be a guide to good practice. The variable factors are: Volume of house per stall, outside temperature range, character of exposure, use of live or exhaust steam, location of fanhouse, space available for fan and amount of heated air to be returned to the fan. In a roundhouse the air should not be returned to the fan. The form of roof affects the heating. An average of about 33,000 cu. ft. of space per stall seems to represent usual construction. About 2,000 cu. ft. of air delivered per minute per stall gives good results.

In the matter of smoke jacks nothing

new has come before the committee. Wooden jacks, fireproofed with paint and sand, appear to be growing in popularity. They do not corrode. Telescopic jacks continue in favor where they are used, also those of tile and those having swinging lower sections to accommodate slight displacements of the engines.

Relative Cost of Running Trains of Slow and Fast Speed.

The committee having this matter in hand reported that among the members there was a feeling that the whole question is one of many variables, and that it is properly much more an operating question than one affecting the design of equipment. The committee also felt that the excellent work accomplished by its predecessors in office, and especially the results reported last year by Mr. Delano, indicate the general results which would be obtained in any investigation, however extensive. Mr. Mackintosh presented a short report, printed in an appendix, in which he gave some information regarding a test made on the C. R. R. of N. J., in which a train of eight empty passenger coaches and a dynamometer, weighing altogether 309 tons, had been hauled from Jersey City to Somerville and return twice by the same engine on the same day. The idea was to run one round trip at between sixty and seventy miles per hour, and the other at not more than thirty miles per hour, and analyze the results. Unfortunately the "slow" train had to be run too fast to give satisfactory results, but the "ground plan" of the test is good and should be repeated.

Fast Time Through Tunnels.

The Shah of Persia, who is making a tour of Europe, has original ideas on the limits of railway speed, and in Italy some amusement has been afforded by the Shah's prejudice against rapid railway traveling. On reaching the Italian frontier he gave orders that his train should not travel faster than 20 miles an hour, and on finding that during the night the velocity had run up to nearly 25 miles an hour he called up the official in charge, and told him to slacken the speed. The only exception to this rule was during the passage of the train through the numerous tunnels which characterize Italian railways. Upon these occasions the Shah let it be understood that he wished the train to rush through the tunnels at full speed, so that he might remain as short a time as possible "in the bowels of the earth."—Ex.

The Lunkenheimer Company, of Cincinnati, Ohio, have recently purchased a large number of Westinghouse induction motors for the equipment of its new works at Cincinnati, Ohio.

Physical Tests of Bethlehem Carbon and Nickel Steel.

The following interesting table of tests, being a comparison of carbon steel and nickel steel forgings, has been sent to us by Mr. Albert Ladd, Colby Metallurgical Engineer of the Bethlehem Steel Company:

COMPARISON OF CARBON STEEL AND NICKEL STEEL FORGINGS.

Physical Tests.	Teusile Strength. Pounds.	Elastic Limit. Pounds.	Ext. Per Cent.	Cont. Per Cent.
Annealed:				
Carbon steel......	109,500	51,440	19.50	36.31
Nickel steel	100,330	66,720	25.00	54.56
Oil tempered:				
Carbon steel......	129,360	67,230	17.50	38.53
Nickel steel......	103,790	76,390	25.00	61.56

COMPARISON OF CARBON STEEL AND NICKEL STEEL LOCOMOTIVE DRIVING-WHEEL AXLES.

	Tensile Strength.	Elastic Limit.	Ext.	Cont.
Carbou steel.......	87,600	45,320	22.00	39.15
Nickel steel.......	91,530	58,800	25.00	48.23

"Bethlehem" nickel steel forgings and nickel steel castings for a narrow gauge locomotive built for Bethlehem Steel Company showed the following physical properties, determined from standard 2½ x ½-in. tensile specimens and 1 x ½-in. bending tests:

NICKEL STEEL FORGINGS.

	Tensile Strength.	Elastic Limit.	Ext.	Cont.
Driving-wheel axles	99,310	64,170	25.00	53.76
Piston rods..........	90,140	60,090	25 50	54.08
Main crauk pins....	93,570	65,450	24 00	49.37
Front crank pins....	92,180	64,170	24.50	51.00
Connecting rods and guides..............	92,040	59,820	26.00	53.01

NICKEL STEEL CASTINGS.

Crosshead............	84,540	53,980	18.50	31.10
Furnace bearer / Bearer guide ..	85,050	54,490	18.00	26.04

Assuming three cents per pound as the cost of introducing nickel into the forgings and castings for this narrow gauge locomotive, it actually cost only $70 to increase certainly twofold the life of the working parts of this engine; and most of this extra cost is returned to the purchaser when he sends the nickel steel forgings and castings to the steel maker for scrap.

How Labor Increases the Value of Iron.

The value of skilful labor is very well illustrated in the increase in the value of iron products through the agency of labor alone. The ore of iron is so plentiful on this continent and so easily reached that it can be delivered to blast furnaces for three or four dollars a ton, which represents the work of mining the ore and transporting it to the point where a smelting plant is ready to separate the iron from the impurities which are always mixed with the ore in its natural state. Iron is never found pure, but some ores are much richer in iron than others, and some are much more easily refined than others.

Under the refining processes the value of iron rises very rapidly. In one of his reports Carroll D. Wright, of the Labor Bureau, says that 75 cents' worth of iron ore when turned into bar iron is worth $5. If you make it into horseshoes it is worth $10, or if into table knives $180. Seventy-five cents' worth of iron ore manufactured into needles is worth $6,800, and when converted into some kinds of fancy buttons it is worth about $30,000. If the iron is made into watch springs the product is worth ten times more than the buttons, and when turned into hair springs it will sell for the enormous sum of $400,000.

All that great enhancement of value is of course due to the labor expended upon it. The converting of iron into hair springs is, to be sure, an extreme case, but every industry devoted to manufacture of appliances from iron give illustrations of the enhancement in value due to labor alone.

Baldwin Record of Recent Construction No. 35.

This number of the Baldwin Locomotive Works publication is devoted to the consideration of rear truck locomotives. There are, however, some observations on boilers in the opening pages. In dealing with rear truck locomotives, the "Bicycle" type or single drivers of the Philadelphia and Reading comes in for mention, then the Atlantic type, the Prairie type, and now comes a new type name, though the wheel arrangement is not novel. The new type name is the "Mikado." This is, if one may so say, a consolidation engine with a pair of carrying wheels at the back. We sincerely hope that this Mikado of the Bismarck, Washburn and Great Falls Railway, like its great namesake in Gilbert's comic opera, will be able to "make the punishment fit the crime" when hauling freight.

Firing Locomotives.

This book by Angus Sinclair tells about the various methods of firing locomotives and gives all the information about the principles of combustion that an engineer or fireman needs to learn. The lessons on that science, although brief, are comprehensive and teach as much as a big volume devoted to details that are of no practical value. A striking feature about the book is the simplicity of the instruction, scientific problems being discussed in every-day language that can be understood by every intelligent person who can read English. The Angus Sinclair Co., 174 Broadway, are the publishers; price, 50 cents.

Colors for French Railway Tickets.

The French railways have agreed upon standard colors for their tickets. For the future, all first-class railway tickets will be yellow, second-class green, and third-class brown. The colors of the return tickets, dog tickets, and half-tariff tickets will be uniformed in a similar manner.

Of Personal Interest.

Mr. A. Tripp has been appointed assistant superintendent of the Charleston division of the Southern Railway, with headquarters at Blacksburg, S. C.

Mr. G. F. Wentworth has been appointed assistant division superintendent of the Northern Pacific Railway, with headquarters at Missoula, Mont.

Mr. C. H. Ackert has been appointed general manager of the Augusta Southern Railroad at Washington, D. C. He succeeds Mr. F. S. Gannon, resigned.

Mr. F. G. Dunbar has been appointed assistant general foreman of the new shops of the St. Louis, Iron Mountain and Southern Railway at Baring Cross, Ark.

Mr. W. B. Leach has been appointed division master mechanic of the Boston and Albany Railroad, vice Mr. C. H. Barnes, resigned. Headquarters, Springfield, Mass.

Mr. John N. Faithorn has been appointed vice-president in charge of traffic of the Chicago & Alton Railway, with offices in Monadnock Building, Chicago, Ill.

Mr. T. F. Dreyfus, motive power inspector of the Pennsylvania Lines, has been appointed general foreman of the Cincinnati and Muskingum Valley Railroad at Lancaster, O.

Mr. H. B. Spence has been appointed general superintendent of the Ottawa Northern and Western, with headquarters at Ottawa, Ont., to succeed Mr. P. W. Resseman, resigned.

Mr. Wm. Meikle has been appointed master mechanic of the Cincinnati and Muskingum Valley Railroad at Lancaster, O. He was formerly general foreman of the same shops.

Mr. A. Machim has been appointed traveling engineer of the Central and Valley divisions of the St. Louis, Iron Mountain and Southern Railway, vice Mr. I. F. Wallace, resigned.

Mr. W. W. Wentz, Jr., general superintendent of the Central Railroad of New Jersey, has been appointed to the same position on the Choctaw, Oklahoma & Gulf Railroad at Little Rock, Ark.

Mr. Samuel M. Nicholson, who has been for a number of years president of the Nicholson File Company, of Providence, R. I., has recently been elected president of the American Screw Company.

Mr. A. C. Ridgway has been made general manager of the company which is about to construct the Denver, Northwestern and Pacific. He was formerly general manager of the Colorado Springs and Cripple Creek Railroad.

Mr. D. E. Cain has been appointed general superintendent of the western grand division of the Atchison, Topeka & Santa Fe Railway, with headquarters at La Junta, Col. He was formerly assistant to the general manager of the same road.

Mr. J. E. Hurley, formerly general superintendent of the Western Grand division of the Atchison, Topeka and Santa Fe Railway, has been appointed general superintendent of the Eastern Grand division, with headquarters at Topeka, Kan.

Mr. Thos. O'Day, road foreman of engines of the Erie Railroad, has been transferred to the New York division of the same road, with headquarters at Jersey City. He succeeds Mr. J. W. Johnson, who will have charge of the Delaware division.

Mr. Charles H. Kenison has retired from the office of master car builder of the Maine Central Railroad, at his own request, after a long term of faithful service. In future the jurisdiction of Mr. Philip M. Hammett, superintendent of motive power, will extend over the Car Department.

Mr. Roger Atkinson has been appointed master mechanic on the Philadelphia & Reading Railway, with headquarters at Reading, Pa. He will have charge of the new repair shops as well as the roundhouses at that point. Mr. Atkinson was formerly with the Canadian Pacific.

Mr. E. H. McHenry has been appointed chief engineer of the Canadian Pacific Railway. The position was rendered vacant by the resignation some months ago of Mr. P. A. Peterson, who became consulting engineer of the company. Mr. Vautelet will be assistant to the chief engineer.

Mr. J. J. Dowling, formerly locomotive foreman of the Great Northern Railroad at Havre, Mont., has been appointed traveling engineer of the Montana division, vice Mr. Geo. Herren, transferred to other duties. Mr. Dowling's long experience as engineer and shop foreman eminently fit him for his present position.

Mr. J. A. Sheffield, who for the past fifteen years has conducted the department of sleeping, dining, parlor cars and hotels over the entire system of the Canadian Pacific, has sent in his resignation. Mr. Sheffield has contemplated this step for some time, owing to ill health. The position vacated by Mr. Sheffield, it is understood, will be filled by his assistant, Mr. W. A. Cooper.

Mr. G. W. Hepburn has been appointed master mechanic of the Chesapeake & Ohio Railway at Covington, Ky. He was formerly assistant master mechanic at the same place, which position will now be filled by Mr. W. R. Morris. Assistant Master Mechanic W. F. Jones has been transferred from Richmond to Fulton, Va., and Mr. J. A. Quinn, heretofore assistant, has been made master mechanic at Clifton Forge, Va.

The many friends of Mr. S. H. Draper will be pleased to hear of his recent promotion from the position of engineer on the Northern Pacific Railway to that of traveling engineer of a district on the Rocky Mountain division of the same road. Since 1883 Mr. Draper has handled an engine throttle with such careful excellence as to gain the complete satisfaction of the officials. He is an expert with the Westinghouse air brake, the system employed by the Northern Pacific, and the lectures and papers he has prepared, on the proper handling of such equipment have been found very helpful for enginemen on the Rocky Mountain division.

Mr. W. H. Corbett has been appointed traveling engineer of the Michigan Central Railway, and the following resolution has been passed on his promotion by the Lake Michigan Division, No. 300, of the Brotherhood of Locomotive Engineers, of which he is a member: "At Division No. 300 last meeting a motion was made to send a letter of congratulation to Mr. E. D. Bronner, superintendent of motive power and equipment, in securing Brother W. H. Corbett as traveling engineer. He is a man who attends strictly to business, and much as we regret to lose him we feel the promotion is to his own interest. Division 300 will lose a good and faithful member. Our best wishes go with him."

The following changes have been made on the Chicago, Rock Island and Pacific Railway: The office of assistant superintendent of motive power has been abolished and Mr. A. L. Studer has been appointed master mechanic of the Kansas division, with headquarters at Horton, Kan.; Mr. W. E. Anderson has been appointed master mechanic of the Colorado division, with headquarters at Goodland, Kan.; the position of general foreman at Goodland has been abolished; Mr. A. C. Adams has been appointed master mechanic of the Oklahoma division, with headquarters at Chickasha, I. T.; Mr. D. D. Robertson has been appointed master mechanic of the El Paso division, with headquarters at Herington. The position of general foreman at Herington has been abolished; Mr. E. O. Cole has been appointed master mechanic of the Nebraska division, with headquarters at Fairburg, Neb.

Rogers Consolidation for the Louisville & Nashville.

An order of fifteen consolidation freight engines for the L. & N. has been partly completed by the Rogers Locomotive Works, of Paterson, N. J. The engines are simple, with cylinders 21 x 28 in. and drivers 56 in. in diameter. The total weight of the machine is 173,000 lbs.

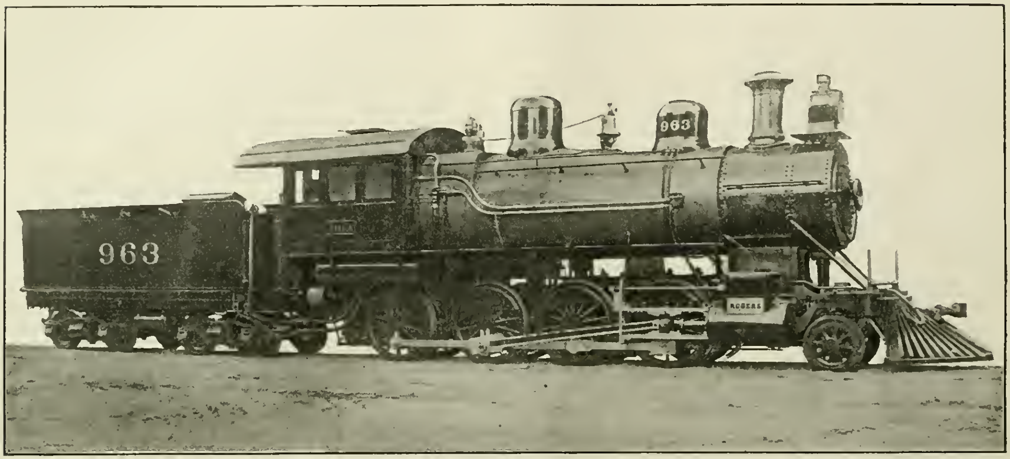
The frames are braced together just back of the cylinders by a cast steel plate 57½ in. long. It is flanged against and may be easily got at without taking down the hose. The cab is large and comfortable, with ventilator on top. The boiler is of the extension wagon-top type, with a belpaire fire box. The engines present a very substantial appearance and are reported to be doing good work.

A few of the important dimensions are as follows:

Fuel, bituminous coal.
Cylinders, 21 x 28 in.; drivers, dia., 56 in.
Driving axle material, steel.
Thickness of barrel, 5/8 in.
Thickness of dome course, 11/16 in.
Thickness of crown, 7/16 in.
Thickness of tube, ½ in.
Thickness of side, 3/8 in.
Wheels, eng. truck dia., 33 in.

TENDER.

Capacity, 5,000 gals; frame, white oak.
Trucks, arch bar type; wheels, dia., 33 in.
Safety valves, 2, 2½ in., muffled.
Lubricators, No. 9, triple sight feed.
Brakes, Westinghouse American.
Boiler covering, magnesia.
Injectors, 1 No. 9 and 1 No. 10, lifting.
Springs, half elliptic; brake beams, iron.



ROGERS CONSOLIDATION FOR THE LOUISVILLE & NASHVILLE RAILROAD.

lipped over the frames, and has vertical and horizontal bolts through the frame, and helps also to stiffen the front frame splice. Altogether it makes a very rigid form of construction. There are three belly braces from frame, the front one being very wide and extending up above the running board. The expansion link is a steel casting with stiffening rib running down the front face. It is suspended by the solid bushed hanger which attaches to both sides of the link. The lifting shaft arm has a bearing 7 in. long. These bearings are larger than usual, and as the link is suspended from both sides, it always retains its true vertical position, wthout the tendency to "lop" over to one side, as is the case when supported in the usual way, from wear of the saddle pin.

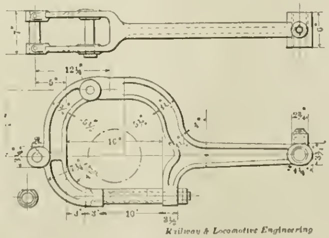
The eccentric rod extension is of cast steel, hook-shaped, which passes round the forward driving wheel, with bottom ends bolted together, with filler piece, so as to completely surround the axle. The eccentric rod extension hanger is also of cast steel with long pin bearings, and has ample oiling facilities.

The tender frame is made of wood. The tank-well has a convenient arrangement at the outer end of the front endsill whereby the strainer and tank valve

Journals, 9 x 11 in.
Driving wheel base, 16 ft 6 in.
Total wheel base of engine, 24 ft. 9 in.

Weight on drivers	155,000 lbs.
Weight on truck	18,000 lbs.
Total	173,000 lbs.
Heating surface, tubes	2,280 sq. ft.
Heating surface, fire box	195 sq. ft.
Total	2,475 sq. ft.

Grate area, 33.3 sq. ft.



ECCENTRIC ROD EXTENSION—L. & N. RY.

TUBES.

Dia., 2 in.; length, 14 ft.
Thickness, No. 11, B. W. G.
Number, 311; material, iron.
Grate, length, 120 in.; width, 40 in.

BOILER.

Belpaire, ext. wagon top.
Dia., outside front, 63¾ in.
Working pressure, 190 lbs.

Mr. Walter D. Crosman has resigned as Western representative of the Gold Car Heating Company, to accept the position of sales manager of the railway department of the Western Roofing & Supply Company, 195 Lake street, Chicago. He will handle a complete line of roofings, linings and coverings, including 85 per cent. magnesia locomotive laggings, roofing and insulating materials for cars and for all classes of railway buildings, pipe coverings, cold water paints, asphalt paints for boiler fronts, etc.

A catalogue issued by the Mark Flather Planer Co., of Nashua, N. H., has been received. It is devoted principally to the description of the planers made by this company and contains half-tones of the various tools with descriptive letterpress opposite. A number of shapers are also catalogued in the same way. The book will be sent to any one interested who makes application.

Those who have had trouble with dynamos on automobiles on account of brushes, would do well to test Dixon's graphite brushes. Those who have tried them have been greatly pleased.

New Passenger Engines for the Missouri Pacific.

The engine just turned out of the Brooks works of the American Locomotive Co. for the Missouri Pacific is a 4-6-2 engine with 20 x 26-in. cylinders and 69-in. drivers. Some years ago an engine with this wheel arrangement was built for the Chicago, Milwaukee & St. Paul road, and one of the technical papers subsequently described it as the "St. Paul" type for that reason.

For purposes of comparison we may mention one with similar wheel arrangement for the Chesapeake & Ohio, now under construction at the Schenectady shops. Both these engines are simple. They have large grate areas and heating surfaces, and are intended for heavy passenger work. The former is somewhat the smaller of the two, but is able to exert a tractive force of 25,600 lbs., while the C. & O. machine, with 72-in. drivers and 22 x 28-in. cylinders, develops a draw bar pull of 32,000 lbs. The comparison of the coefficient of adhesion, or in other words, the ratio of tractive power to weight on drivers of these engines is interesting. The C. & O. engine gives 4.09, while the Mo. Pac. engine gives 4.68 as the coefficient of adhesion. The former will pull a greater load, but the latter is thus seen to make very good use of its adhesive weight.

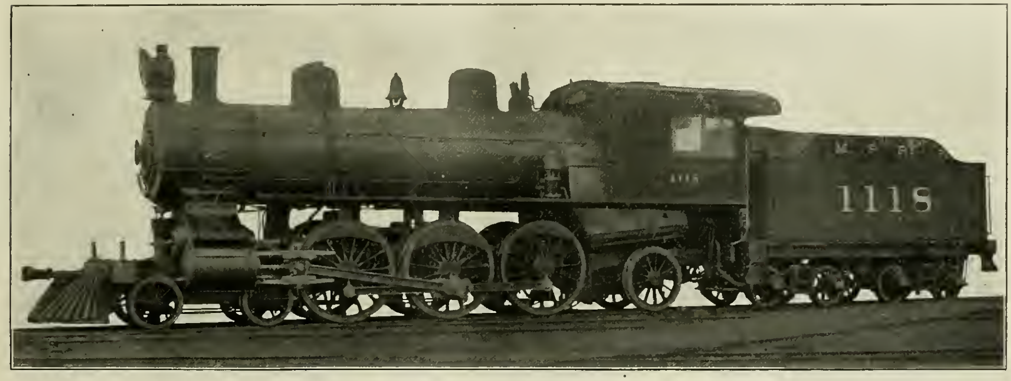
The Missouri Pacific locomotive has steel castings used in its construction wherever it is desirable to reduce weight. The driving wheels and the carrying truck are all equalized; steel equalizer castings pivoted upon circular pins are used throughout. The spring hangers have top joints made of steel castings of hook-shaped section, with side webs. They grasp a slightly raised knob on the ends of the springs. This makes a strong though flexible form of construction, which has advantages which will be appreciated in the round house when the work of changing springs comes to be done.

On examining the frame, one sees that the pedestal binders for the main and leading drivers are of the usual form, with deep notches for the pedestal ends. Where the trailing driver is placed the frame lends itself more readily to a pedestal binder of the clamp form, which is accordingly used. The bottom of the jaws for the carrying wheels is secured by a bolt, in each case, with filling piece between jaws. The Player patent ash pan with gravity closing doors is part of the equipment.

A novel feature, where simplicity of construction, lightness and strength are apparent, is in the reach rod, which is made of a piece of wrought iron pipe, screwed into steel joints at each end. The expansion link is of cast steel with stiffening rib running down the center of its forward side. The valve transmission rod is also of cast steel, and passing over the leading axle gives a direct connection to the valve, and permits the removal of the forward driver without any disturbance of the valve gear.

The main valves are of the piston type, inside admission. They are described in the specification as of improved form. The valve is made up of three pieces, a center portion, hollow and flared out at each end; and two followers. Against these ends the followers are held tightly by the valve stem, with collar for the forward follower, and a pair of nuts at the back end. Each follower is keyed to the valve stem to prevent rotation. The followers each carry a bull ring, in each of which two packing rings are placed. The bull ring is prevented from rotating by a suitable key fitted into the follower, and each packing ring is prevented from turning on the bull ring by horizontal dowel pins. The bull ring is notched on each side, with slight overhang, into which, with due allowance for free play, a corresponding notch in the packing ring fits. One side of each outer ring touches the follower and the inner is against the valve's central piece. The whole arrangement keeps the packing rings, bull rings, and followers in the same relative position to one another, giving ample facilities for minimum renewal in case of wear. The notched bull and packing rings permit the latter to fulfil their function without the possibility of springing out into a port in case of accidental overtravel, and if broken the parts are held securely in place. The loose bull ring permits a sort of automatic self-centering process when the packing rings are in working order and holds them tightly against the walls of the valve chamber.

A few of the principal dimensions of the Missouri Pacific engine are here appended:



FAST PASSENGER ENGINE FOR MISSOURI PACIFIC RAILWAY.

GENERAL DESCRIPTION.

Kind of fuel to be used, Bituminous coal.

Weight on eng. truck wheels...........	31,000 lbs.
Weight on driving wheels...............	120,000 lbs.
Weight on carrying wheels............	22,000 lbs.
Total weight of eng......	173 oco lbs.

Weight tender, loaded, 110,000 lbs.

GENERAL DIMENSIONS.

Wheel base, total, of eng., 30 ft. 5 in.
Wheel base, driving, 12 ft. 4 in.
Wheel base, total, engine and tender, 55 ft. 1½ in.
Length over all, engine, 44 ft. 8¾ in.
Length over all, total, eng. and tender, 67 ft. 9½ in.
Height of stack above rail, 15 ft. 4½ in.
Heating surface, firebox, 152 sq. ft.
Heating surface, water tubes, 22 sq. ft.
Heating surface, tubes, 2778.5 sq. ft.
Heating surface, total, 2952.5 sq. ft.
Grate area, 42.4 sq. ft.

WHEELS AND JOURNALS.

Wheels, eng. truck, dia., 33 in.
Wheels, driving, dia., 69 in.
Wheels, carrying, dia., 49 in.
Material of wheel centers, steel.
Type of carrying truck, improved radial.
Journal, eng. truck axles, 5½ x 12 in.
Journal, driving, 9 x 12 in.

CYLINDERS.

Dia. 20 x 26 in.
Piston rods, dia., 3⅝ in.

Steam ports, length, 25½ in.
Steam ports, width, 1⅞ in.
Exhaust ports, least area, 65 sq. in.
Bridge, width, 3 in.

VALVES.

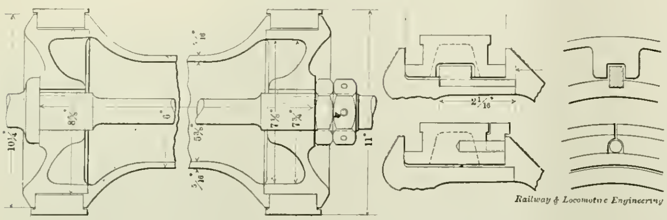
Improved piston; greatest travel, 5 5/16 in.
Steam lap (inside), 1⅛ in.; lead in full gear, 0.

BOILER.

Type of, radial stayed wagon top.
Working pressure, 200 lbs.
Thickness of material in shell, 21/32, 11/16, 9/16, ½ in.
Thickness in tube sheet, ¼ in.
Dia. of barrel, front, 64 3/16 in.
Dia. of barrel at throat, 69⅜ in.
Seams, kind of horizontal, sextuple riveted.
Seams, kind of circumferential, triple riveted.

FIRE BOX.

Type, wide; length, 78 in.; width, 80 in.
Depth, front, 77 7/16 in.; depth, back, 63 in.
Thickness, crown ⅜ in.; tube ⅝ in.; sides ⅜ in.
Brick arch, on water tubes.
Mud ring, width, 3½-in. back; 3½-in. sides; 6-in. front.
Water space at top, 6-in. top; 6-in. sides; 6-in. front.
Tubes, number of, 256; outside, 2¼ in.
Tubes, thickness, No. 11, B. W. G.
Tubes, length over tube sheets, 18 ft. 6½ in.



PISTON VALVE.—MISSOURI PACIFIC RAILWAY.

SMOKE BOX.

Stack, taper; least dia., 15 in.
Stack, greatest dia., 17 in.
Stack, height above smoke box, 37 in.

TENDER.

Tank, type, water bottom.
Tank, capacity for water, 5,000 gal.
Tank, capacity for coal, 10 tons.
Type of under frame, steel channel.
Type of trucks, all metal.
Type of springs, double elliptic.
Dia. of wheels, 33 in.
Dia. and length of journals, 5 x 9 in.
Dia. of center of axle, 5⅝ in.
Height of tank, not including collar, 5 ft. 1¼ in.
Type of draw gear, M. C. B. coupler.

SPECIAL EQUIPMENT.

Brakes, Westinghouse automatic, for tender and train service.
Pump, American outside equalized on all drivers, 9½ in., W. A. B.

Crossing the Atlantic.

BY ANGUS SINCLAIR.

A man who is accustomed to observing things for the purpose of writing about them is likely to find on an ocean voyage many strange facts and incidents that make good subjects for description. Some philosopher says that the most interesting entity in nature to study is man. On a sea voyage one finds this entity in a concentrated form, and presenting along with his sister woman, an entertaining subject to dwell upon. The denizens of an ocean liner constitute a miniature world in themselves, and their varied features and idiosyncrasies are seen like an open book. People talk about the ennui and monotony of an ocean voyage, but these mental burden oppress only those who have ears and hear not, eyes and see not. To the observing person the voyage is a continuous drama with varying touches of comedy and tragedy appearing every hour. The table where I eat my meals forms a small world in itself, even for the portion where conversation can reach. Close beside me a small comedy goes on when the weather is good, and it turns into semi-tragedy when the billows roll, "which is frequent and free," as Bret Harte says. There is a young girl on my right, about nine years old, who has exceedingly dignified manners, and is prim in her walk and conversation. On the other side is a boy of about eight, who is evidently the tyrant of a household, and is accustomed to have his own way. He makes attempts at intercourse with the girl, but she receives his advances very frigidly. In revenge he makes faces at her and she has lowered her dignity sufficiently to make a mou, as the French say, at him. But there is amusing side play going on all the time. The older people display their own peculiarities, but I must not begin writing about them or there would be no room in this letter for "practical" writing.

I shall merely mention one incident that has amused me. George Westinghouse, Jr., is a passenger. He is a wonderfully modest young man, thoroughly free from self-consciousness. Yesterday he remarked to me "the people on this boat seem to be as free in their manners as they are said to be in the far West. All sorts of people, men and women, come up and talk to me without any introduction. I never saw such friendly people." I did not take such a good-natured view of the friendliness. Not a few of them were snobs who wanted to be able to say that they had made the acquaintance of young George Westinghouse during the voyage.

Nearly all who are responsible for the care of transportation machinery think that they have a little more tribulation than the people in other lines. We all know about the griefs that arise from bad steaming locomotives, and from the provoking failures of the

machinery. Some of us have had experience with automobiles that stall tar away from home from no comprehensible cause and leave us to the humiliation of escorting our best girl home on the trolley car. But there is an impression that marine machinery is exempt from the ills of locomotives and automobiles and that the engines keep up their rote of work from continent to continent without shadow of fault or failure. I know better. I am aware that forty feet below the deck of this good United States mail steamer St. Louis there is tribulation and murky sweating and swearing low and deep because the boilers are not making steam as freely as the cylinders want to use it in driving the twin propellers.

This condition of affairs is nothing strange or novel. When I crossed two years ago on the "Majestic" Chief Engineer Barber was nearly tearing his hair, over the quality of the coal which lay on the grates like lumps of stone and, as he alleged, would not make heat enough to roast a herring. Here bad coal is also the cause of complaint, and the coal strike is held responsible. Be that as it may, the lack of steam has reduced the speed three knots per hour and has increased the time of the voyage about one day. The boilers are, however, seven years old, and there may be something besides inferior coal preventing them from steaming freely.

There is no doubt considerable annoyance experienced with marine boilers failing to supply steam so rapidly as it can be used by the engines, but marine machinery is remarkably free from breakdowns that cause serious delay or put the power temporarily out of use. In looking over statistics of steamship operating for a series of years, I find that in 1892 about 4,000 steamers left both sides to cross the Atlantic, and out of that number there were only seven breakdowns that caused serious delay, and only three that caused total disablement. The locomotive and the automobile must hide their diminished heads before that record.

The steamer St. Louis embodies the most advanced practice in marine engineering, and forms a good illustration of the great progress made since steamships first began to cross the Atlantic. The first attempt to put a passenger steamer in service on the Atlantic trade was made in 1838 with the "Royal William," a vessel 145 ft. long with a carrying capacity of 720 tons and having simple condensing engines of about 400 horse power. This boat was not a shining success, but she crossed the Atlantic in about twenty days and stimulated thereby the public taste for rapid transit. The sailing ships took from thirty to forty days, so the pioneer steamers were a decided improvement. By this time railroads were becoming common, and extraordinary speeds of thirty miles an hour and over were sometimes attained, so it was natural that people, who were compelled to undertake the hazardous experience of crossing the ocean should insist on being transported at more than a walking speed, which was about the pace of a sailing vessel.

The first really successful steamboat to enter the Atlantic trade was the "Great Western," of Bristol, England, which made the first passage between Bristol and New York in thirteen and a half days and kept up an average of about fifteen days. At that time all marine engines used jet condensers, so that the boiler was fed by sea water, which caused much trouble from salt and lime deposits. The steam pressure seldom exceeded twenty pounds per square inch, which entailed the use of enormously heavy machinery for the power developed. It is calculated that were the St. Louis required to develop her present power with engines and boilers of the kind used on the "Great Western," the ship would be completely loaded with engines and boilers alone.

The first radical improvement effected on marine engines was the introduction of the surface condenser. This is a vessel into which the steam from the cylinders passes through small tubes that are surrounded by cold water circulated from the sea. In these tubes the steam is condensed and then pumped back into the boiler. By this means the water in the boilers is always soft and free from mineral impurities. First-class steamers now carry distilling appliances to provide fresh water required by leakage of the boilers, so that no sea water is now used.

The surface condenser made its way slowly into favor, and with it came higher boiler pressure. That in its turn led to compound engines, and the development in that line, is quadruple expansion engines, which are the kind used on the St. Louis. In that system the steam from the boiler passes into the high pressure cylinder and then through three others before being exhausted into the condensers. As the vessel is driven by twin propellers, two sets of engines are required to turn them, which, in themselves, form a great aggregation of machinery. When to the main engines are added electric light machinery, refrigerating machinery, steering and pumping machinery, it will be understood that engineers have an immense number of details to attend to.

The perfecting process carried out on the marine engine has effected a very important saving on the cost of power. The earlier forms of marine engines, such as those employed by Fulton, required about ten pounds of coal per

hour for each horse power developed. The use of surface condensers with higher boiler pressure gradually reduced the coal consumption to about four pounds per horse power per hour; then compound engines also with higher pressures reduced the coal consumption to about two pounds per horse per hour; and now with quadruple expansion the St. Louis uses only about 1.5 pounds of coal per horse power. An eminent British statesman once remarked in addressing a meeting of farmers, "the man who makes two blades of grass grow where one grew before is a benefactor to his countrymen." In view of the fact that the stored forces of coal are limited it is surely just to say that "the men who have made one and a half pounds of coal do the work that previously took ten pounds are benefactors of mankind." The engineer is the modern magician. He controls the most potent forces of nature, and turns those which have been running to waste since the birth of time into useful channels.

The steamers St. Louis and St. Paul of the American line were built by Wm. Cramp & Sons, Philadelphia, in 1895, and are of the same general dimensions. The length on the water line is 535 feet and over all 554 feet by 63 feet wide and 42 feet deep. These figures do not appeal to an ordinary person unless he measures off the distances and studies them at leisure. The promenade deck is cut off by considerable length at the bow and stern, but we found by actual measurement that seven turns around it made a mile.

There are ten Scotch boilers for supplying steam that have an aggregate of over thirteen miles of tubing. The two sets of engines are capable of developing 20,000 horse power but they are only worked to develop about 16,000 horse power. It is difficult for the ordinary mind to grasp the meaning of the immense force of 20,000 horse power. It is more than the hauling capacity of twenty of the largest consolidation locomotives.

A distinguished Englishman recently compared a vessel propelled by such engines with an ancient galley propelled by oars. "Take her length as being some six hundred feet and assume that place be found for as many as four hundred oars on each side, each oar worked by three men, or two thousand four hundred men in all; and allow that six men under these conditions could develop work equal to one horse power; we should have four hundred horse power as the result of the work of the two thousand four hundred men. Double the number of men, and we should have eight hundred horse power, with four thousand eight hundred men at work, and at least the same number in reserve, if the journey is to be carried on continuously." Contrast the puny result thus obtained with the power of the engines of the St. Louis and St. Paul, either of which are capable of developing on the above mode of calculating a power equal to that of one hundred and seventeen thousand men, and that is without allowing for constant relays. And it must be remembered that while these engines are the prime motors of the ship, she is equipped with over fifty smaller ones for ventilation, refrigerating, hoisting and the almost innumerable functions involved in operating her.

It is a good thing to have ships of this character built in the United States, but the talk about the advantages of having them sailed under the American flag is deceptive sophistry. All the people employed in this line have their homes in Europe, and they are paid the same wages as the seamen, firemen, stewards, engineers and officers of foreign steamship lines trading to the same ports.

New Book on Electricity.

A careful review of "The Electrical Cathechism," compiled from the regular issues of *Power*, impresses us with the fact that it is a valuable book for students of electricity. It is not only for the educated college man, but is wholly within the reach of the man with an ordinary school education. The elementary portion is simple, comprehensive and gives an excellent start to the beginner. As the book progresses, and higher and more complicated matters are brought in, it is evident that some knowledge of mathematics becomes necessary; but nowhere in the book does mathematics become so complex or abstruse as to seriously check or block the student. Of course, a little more mathematics is necessary than mere addition, substraction, multiplication and division, and this is true of all electrical works beyond elementary electricity. Simple and elementary algebra is used, but in so doing much greater things may be, therefore, handled and higher knowledge brought within the scope of the student, which he would not otherwise be able even to touch with the four simple rules of arithmetic. Algebra should not be objectionable to the ordinary railroad man. He had better prepare himself in simple algebra in order to enter the fields of practical electricity.

While there is nothing essentially new in the subject, still the method of its treatment, its cathechism form and its originality appeal strongly to the student who is satisfied to go a little beyond ordinary arithmetic in his work. The book contains 205 pages, and is published by the Hill Publishing Company, New York, 1902 edition. Price, $2.00.

Of Interest to Signalmen and Others.

Sir Robert Ball, the eminent English astronomer, when in this country, was asked about the probable success of any system of signaling to the inhabitants of Mars, supposing there are any. He replied that if the wig-wag system were to be employed, the people on this earth would require to use a flag 200 miles wide by 300 miles long, waved upon a pole 500 miles high. He also said that if Lake Superior was filled with kerosene and set on fire, the conflagration which would result might possibly be seen by a Martian astronomer if he was particularly vigilant and very observing. The Martians will not be signaled for a few days.

Philippine Cruisers.

The Philippine Insular Government, which is the name under which United States authority is exercised in our new possessions, are building 15 small cruisers for use in the waters of the archipelago. The Tabor steam engine indicator, made by the Ashcroft Manufacturing Company, 85-89 Liberty street, New York, has been specified as part of the equipment of these ships.

The Hayden & Derby Manufacturing Company of New York have also been informed that their "Metropolitan, 1898, injector, model "O" has been adopted as standard on these class "A" cruisers. The contract for the injectors was secured by F. W. Horn & Co., of Yokohama, Japan, who are the agents for the Hayden & Derby Co., of 85 Liberty street, New York.

Light Reflected on Signal Arms.

An engine driver of the North-Eastern Railway, of England, has designed an arrangement of the signal lamps, by means of which the light is reflected on to the signal arms at night, thus enabling drivers to distinguish "home" from "distant" signals as easily by night as by day. That some such arrangement is necessary all enginemen must admit, especially when drivers are working over roads with which they are not thoroughly acquainted. It is also claimed that by thus showing the arms, engine drivers are better able to "read their road" at places where several signals are placed on a gantry, the mere lights of which are often confusing. The practice of projecting a light upon platform indicators, which are provided for the guidance of drivers at terminal stations, such as London Bridge and Cannon Street, has been in vogue for some years.—*Railway Magazine.*

Edwards Railroad Electric Light Co.

The Edwards electric headlight catalogue has been received. This is a very interesting little publication from the fact that not only does it contain excellent half-tones of the various sizes and designs of electric headlights and a perspective section showing all parts in place, but the catalogue deals with each of the details very fully, so that anyone desiring information as to how these arc lamps are made and how they operate, can get it from a perusal of the pages of the Edwards catalogue. This is the headlight which throws a vertical beam of light up to the sky in addition to the regular, brilliant track illumination. The catalogue will be sent to anyone interested, who applies to the company; principal office, corner Sixth and Baymiller streets, Cincinnati, Ohio.

Perpetual Motion.

It may seem almost unnecessary to state that the principle known as the "conservation of energy" is still in force, and so long as it lasts, perpetual motion is impossible. The connection between these two may not be plain at first, but they are closely allied nevertheless. Energy once produced never goes out of existence. Some force must always produce it, and after it is produced it can only give out an amount equal to the stock on hand at the commencement of operations. If it were possible to realize all of this in useful work, perpetual motion would only be possible to the extent of making a machine revolve without doing any work whatever. In all cases some energy is dissipated in overcoming friction, and this makes the energy that can be utilized less than the amount put into any machine, therefore perpetual motion in the ordinary sense of the word is, and must be forever an impossibility.—Ex.

Oils Which Do Not Drip.

Superintendents of motive power, master mechanics and air brake officials will be interested to learn that the New York and New Jersey Lubricant Co. have issued what may be called a vest-pocket brochure on the subject of "Oils Which Do Not Drip." In this little explanation of the work done by their product they point out the well-known fact that fluid oils, although undoubtedly friction reducers, are not only very liable to drip, but do drip, and are consequently wasted. In addition to this waste, the dripping of oil rots wood, makes a mess upon the floor, and increases the danger of fire both from oil-soaked wood and from spontaneous combustion. Wiping up this drip oil, uses waste. If an oil user is desirous of escaping all this and "flies to grease," if one may so say, then the writer of this little pamphlet points to the fact that grease when used in bearings allows them to grow warmer than they would with fluid oil, in order to soften the grease sufficiently to make it feed on to the journals, and, furthermore, that grease leaves a gummy residue which is deposited between the bearing surfaces. This increases the friction,

and so actually takes more power from the engine, and this means more fuel used.

Fluid oil, then, drips and wastes, grease does not drip, but requires a bearing to warm up, before it will cool it down, and its residue is a friction producer. At this point the non-fluid oil steps in as the "golden mean," with none of the disadvantages of either, but the good qualities of both. All this sounds very much like an oft-told tale, but the point which will interest railroad men is not so much that this lubricant is the very thing for the cams of looms and machinery in textile mills; but that it will take hold of the inside of an air-brake cylinder and will lubricate it, without working its way to the bottom, or forming into little balls, and ceasing to act.

This non-fluid oil, it is said by many large users, will keep the pores of the packing leather full, making it pliable and effectually putting an end to leaks. It will remain on the walls of the cylinder spreading evenly and smoothly over the surface, and will keep at its work longer than the "oldest leather" in air-brake service has ever known. Users of these non-fluid oils also say that this non-fluid oil will lubricate triple valves and slide valves of air-brake equipment, and will not run down to the emergency seat of a triple valve and destroy it, and that the cutting of the face of the triple slide valves has been reduced one-half.

The company comes out with this offer at the end of the pamphlet, to show that these statements are made in good faith: "We offer to send a large testing sample, express prepaid, free of charge. We are sure we are right, but, right or wrong, we want your judgment." There are the claims, there is the offer; 14 and 15 Church street, New York city, is the address.

The Bull-Pup Wins.

"C., H. & D." are the magical letters that every fortunate holidayer who can afford the time and money writes upon the tablets of his mind ere hay fever marks him for her annual own. "Cincinnati, Hamilton and Dayton" is the obvious signification of these magical letters, but there is hidden in them something even more mysterious—the key-words to a pretty tale of a summer girl, her dog and a young man, in the wilds of Northern Michigan. Cupid dons many disguises to accomplish his ends, but few would recognize the gentle god, incarnate in a ferocious bull-pup of uncertain temper whose loss involves Mr. J. Bruce Chalmers and Miss Maud Hamilton in a correspondence that eventually leads to the hymeneal altar, via Mackinac, via the C., H. & D.! But so the story runs in the pretty and unique folder "On the Way to Michigan," issued by the passenger department of this road. The magical initial letters are, after reading this story, seen to disclose the identity of the chief actors in the little comedy of love:—Chalmers, Hamilton and Dog!

As the train speeds on, the united lovers, just beginning the honeymoon, smile at each other, and Maud says: "Isn't it Charming, Happy and Delightful?" To which he replies: "Certainly, my dear, that is C., H. & D."

Commonwealth Steel Company.

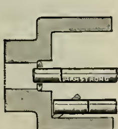
The catalogue of the Commonwealth Steel Company has been received. The cuts are all printed on tinted paper and the letter press concerning each is placed on the opposite page. This concern makes an arch bar truck, combined with a swing motion bolster, so arranged that it does away with truck transoms. The bolster swing with the spring seats which are pivoted to the top of the truck columns. These columns are connected together at their lower ends, thus forming one piece. The catalogue will be sent to any one, upon application. Bank of Commerce Building, St. Louis, Mo.

A Safety Feature of Bascule Bridges.

A short time ago there were, with a few minor exceptions, no other type of drawbridge used in the United States but the swing bridge, requiring a central pier and swinging in a horizontal plane. Many fatal accidents have occurred with this form of bridge by trains running into an open draw owing to some accident by which control of a train was lost. In Chicago and Cleveland there have been recently erected drawbridges of the Bascule type, known as the Scherzer rolling lift bridge. These bridges are built on the same principle as that of the drawbridge of an ancient castle—that is, they lift in a vertical plane instead of swinging horizontally. An accident recently occurred in Chicago on a rolling lift bridge on the line of the Metropolitan West Side Railway that brought out, incidentally, a safety feature of this type. The motorman of an electric elevated train disregarded the danger signal, or lost control of his train, and ran into what corresponds to an open draw, but because of the angle at which the span stood, the cars ran part way up and then stopped and ran backward without causing serious damage to either the cars or passengers.

Hydraulic Mining Stopped.

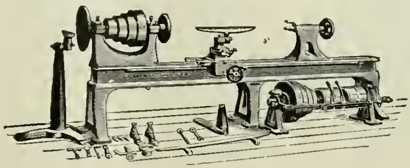
Hydraulic mining having been prohibited by the National Government in many parts of California, the hydraulic development companies are turning their attention very profitably to power and irrigation projects. The Central California Electric Co. has recently purchased two 1,000-k.w. Westinghouse alternating-current generators, which will be direct con-



nected to water wheels and used to supply power to Grass Valley, Nevada City, Sacramento and adjacent towns. This is the third station to be installed by the company, two other stations having now been in operation for a number of years. The Central California Electric Company's system is a part of that of the South Yuba Water Co., which controls 400 miles of main ditch line in the heart of the Sierra Nevada Mountains. Formerly the water was used for hydraulic mining, but this having been stopped on account of the filling up of the rivers with "slickens," the water is now supplied to ranchers and fruit growers for irrigation purposes. Before being sold to the farmers, however, it is transmitted in pipes to stations at different points along the system where electric energy is produced and conducted 35 to 50 miles to adjacent cities.

A New Pattern Maker's Lathe.

We illustrate a new tool just brought out by J. A. Fay & Egan Co., of No. 445 West Front street, Cincinnati, O. This new lathe, which has an iron bed, will be found invaluable in wood-working establishments, and has double face plates,



J. A. FAY & EGAN LATHE.

movable carriage rest, foot post and floor stand; it is capable of swinging 30 ins., and is constructed as strongly as possible. The spindle is of large diameter, lead-ground and fitted with a 12-in. face plate on one end and an 18-in., on the other, the outside face plate being clear of the end of the shears, will allow turning extra large circles. The tail stock is operated by hand wheel and screw, and locked by a hand wrench, it is absolutely true with the head stock. The movable carriage is gibbed to the shears and supports a cross slide which carries the rest, and tool post; it is moved by rack and pinion feed, operated by a hand-wheel, and is very useful in turning cylinder patterns and other long material. This machine will be supplied with or without the bed. The manufacturers will furnish prices and full particulars on application, and will also forward their large new illustrated poster free.

Off for Europe and South Africa.

Mr. G. P. Altenberg, foreign manager of the J. A. Fay & Egan Co., has just left on his annual trip to Europe, where he will visit the principal countries in the interest of his firm. He will also go to South Africa, where he will organize agencies and representatives. The termination of hostilities there has opened up a fine market for the products of the company, and with their usual activity they are losing no time in taking advantage of this opportunity to introduce their wood working machinery.

The address of Mr. Altenberg while in Europe, will be at No. 51 Wharton Road, Kensington, London, W., England.

To Find the Width of a River

To measure the width of any ordinary stream or even of a good-sized river, it is necessary to make use of only your eyes and the brim of your hat. That seems queer, doesn't it? But it's true, and here is the way to do it:

Select a part of the river bank where the ground runs back level, and, standing at the water's edge, fix your eyes on the opposite bank. Now, move your hat down over your brow until the edge of the brim is exactly on a line with the water line on the other side.

This will give you a visual angle that may be used on any level surface, and if, as has been suggested, the ground on your side of the river be flat, you may "lay off" a corresponding distance on it. To do this you have only to hold your head perfectly steady, after getting the angle with your hat brim, supporting your chin with your hand, if necessary, and turn slowly around, until your back is toward the river.

Now take careful note of where your hat-brim cuts the level surface of the ground as you look out over the latter, and from where you stand to that point will be the width of the river—a distance that may readily be measured by stepping. If you are careful in all these details you can come within a few feet of the river's width.—*North American.*

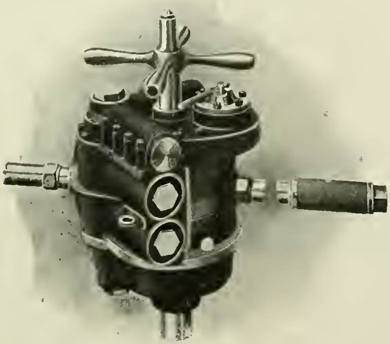
Pratt & Whitney Catalogue.

The Pratt & Whitney Co., of Hartford, Conn., have just issued a small catalogue concerning their new 10-in. x 5 ft. toolmakers' engine lathe. The pamphlet is illustrated by half tones, showing the end view, the rear view, a view of the lathe head, with draw-back collet in position, and showing threaded and conical section of the head spindle end, and a view of head with step chuck and closer shown in position. A line engraving illustrates the cross section of the bed through the center of the carriage. The letterpress gives full information regarding this lathe and all its parts. A copy of this catalogue will be sent to anyone interested, on application, either to the Pratt & Whitney Company or to the Niles-Bement-Pond Company, 136 and 138 Liberty street, New York.

Little Giant Reversible Drill.

We illustrate herewith a new reversible drill of the "Little Giant" type recently developed and put on the market by the Chicago Pnuematic Tool Co. This machine was primarily designed to meet the wants of customers who require a drill for general use, but whose work is not sufficiently specialized to warrant the use of any one of the "Little Giant" machines, designed exclusively for reaming and tapping.

The motor in the reversible drill is of the same general construction as all of the now well-known "Little Giant" drills, the distinguishing feature of which are four single-acting pistons coupled to one crank shaft at an angle of 90 degrees. Each piston of each pair traveling in opposite directions all the time, insures a well balanced and durable engine. All moving parts work in an oil-tight case, and each pair of cylinders is controlled by one balanced piston slide valve. These features are fully covered by United States and foreign patents, and are not found in other pneumatic drills. To this form of construction has been added a simple reverse valve, the same as is used in Nos. 11 and 12 machines, but the valve is so situated that it does not interfere with the feed-screw, when machine is being used as a simple drilling machine. The controlling lever may be removed from motor when not required as reversible machine. The drill can then be controlled by the ordinary throttle, which is situated at side of machine, as in the plain drills.



"LITTLE GIANT" REVERSIBLE DRILL.

The reverse valve can be used as a throttle valve, however, when very rapid and accurate reverse motion is required, as would be the case when the motor was used in connection with a machine for setting locomotive slide valves, or for tapping to a given point or to bottom, and also for various other applications which will readily suggest themselves to the mechanic requiring a machine of this kind. Like parts of these drills are interchangeable with the plain drill of same size.

Some of the improvements appreciated by mechanics who have used these drills are that all bearings are furnished with removable brushings; the crank journals have been increased by 50 per cent.; the crank pinion is now shrouded on both ends (formerly on one end only)—this prevents teeth from breaking; the upper and lower bearings for crank shaft are bronze; sleeves of ball and socket form, easily removed—no screws required to hold them in place. This form of bearing always insures perfect alignment and allows of increase in speed and power; hardened steel eccentric straps connect valves to crank shaft in place of bronze, formerly used; oil plugs have been dispensed with; oil is poured in through the handle, and, as it is impossible to use this drill without its own handle, and as nothing but the proper handle will fit the hole, it will have to be replaced, even by the most careless workman, and this fact insures long life to the working parts. A leather-packed stuffing box is supplied to keep the oil from escaping, and every moving part is hardened and ground to fit.

The Philadelphia Pneumatic Tool Co. have concluded arrangements for representation in South Africa with headquarters at Johannesburg. Their agency will be in charge of General Samuel Pearson, late of the Boer forces. Mr. Pearson has been in the United States for some months, and now that peace has been declared he returns to his former business in machinery lines, and will handle the accounts of the Philadelphia Pneumatic Tool Co. and others. Before coming to America Gen. Pearson saw active service in the field and was for a time in charge of railway traffic.

The illustrated catalogue of this company has come to hand. The various air tools made are fully set forth. The Keller pneumatic hammer, in its various sizes, is shown and tabulated, with illustrations of the kind of work it may be employed on. The Keller pneumatic rotary drills are also enumerated, with short description of each size and style. The Keller pneumatic foundry rammer, "the tool that can pound sand," comes in for mention. In working this tool there is next to no jar on the hand of the operator. Molds can be rammed much harder and more quickly than can be done with hand work. Catalogues supplied to those interested upon application.

A neat little catalogue has just been issued by the American Air-Compressor Works, whose office is at 26 Cortlandt street, New York. The merits of a few of the American types of air compressors made by the company are set forth. The catalogue will be given away upon application. This company also makes gas pumps, vacuum pumps, tar pumps, air receivers, air hoists and compressed air tools and appliances of all descriptions.

The Tabor Manufacturing Company have recently received an order from the Bethlehem Steel Company for ten molding machines which will be the largest molding machines ever built. They will be used for molding the steel castings that will form the lining of the great tunnel to be built by the Pennsylvania Railroad Company under the Hudson river, to connect the railroad system with a great underground station about to be constructed in New York city.

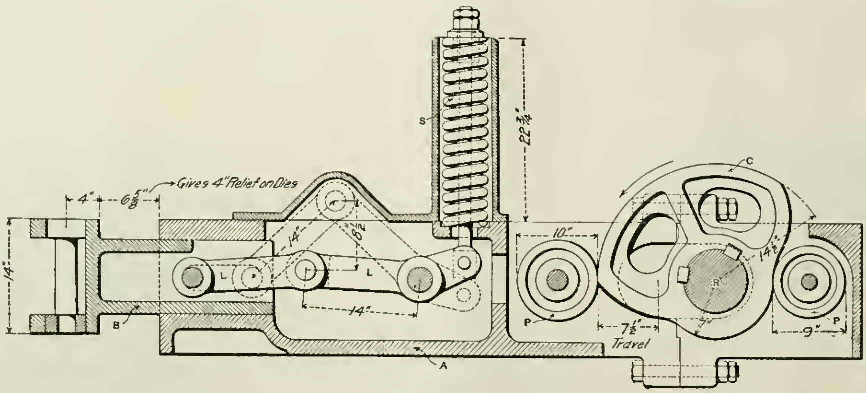
The Otley Cement Company, of Chicago, have recently changed their name, and have been incorporated as the Otley Manufacturing Company. The new concern will continue to manufacture Eureka steam joint cement and asbestos goods. In addition, the manufacture of Eureka fireproof iron paint, Eureka graphite pipe cement, Eureka iron fillers, Eureka graphite paint, and Eureka front end luster, will be taken up. The company's office is in the Chamber of Commerce Building, Chicago.

The Fort Wayne Electrical Works (incorporated) has issued Bulletin No. 1024, which deals with Type M. P. L. direct connected generators. The illustrations in this bulletin show the various parts of the generator, and in connection with the description of the general construction give information as to how these machines are made and how they operate. A couple of fine engravings with tables of general dimensions are given. The bulletin will be sent to any one who addresses this company at Fort Wayne, Ind.

The Herron & Bury Manufacturing Co., of Erie, Pa., are willing to distribute a neat little catalogue on air compressors, particularly of two types recently designed. They are the "Straight Line" compressor, Class "A. S.," and the "Center Crank," Class "B. B." Tables of sizes are given, but no descriptive matter accompanies the illustrations, because the manufacturers believe they can give more useful and comprehensive information by answering inquiries from interested persons direct.

Acme Four-Inch Upsetting Machine.

This 4-in. upsetting and forging machine has been designed to meet the requirements of locomotive builders, car builders and other users of heavy forgings where the constantly increasing size of product has demanded the use of larger and heavier parts entering into the construction of the tools used. This machine has a bed which is a single steel casting weighing 18½ tons; this makes it as strong as a cast iron bed of four times the weight would be. The shaft is a fluid-compressed steel forging. The grip-slide, toggle-head and moving die-block are steel castings, the toggle links are heavy tool steel forgings, hardened. These links are four in number, thus giving a perfectly even motion to the die block as it moves to its place in closing, no matter whether or not the dies are at either extremity of the die blocks. This is of great importance in forging close to size, because so wide a die block as this (about 2 ft.), if moved with a single pair of links, when the dies were at one end of the block, would be very apt to close the dies unevenly. The mechanism which closes the dies is designed to give the very largest measure possible of what is known as "time," that is, the period the dies remain closed with reference to the advance of the upsetting plunger. This advance is known among mechanics, familiar with these machines, as "gather." This means that the dies themselves close quickly enough, and after they are firmly closed, the plunger has as long a distance to travel as it is possible to get. The upsetting begins after the dies are firmly closed, and it is desirable that the plunger shall travel as far as it is possible to make it, and yet to have the piece being upset carry straight. The machine is able to give a plunger pressure of 100 tons, and to give a die pressure of 65 tons before the automatic relief becomes operative. This automatic relief is of new and novel construction, on which the company has already been granted a patent. A spring is so placed that, when there is only about 10,000 pounds pressure on the spring, it exerts a pressure through the dies of 65 tons. Any pressure in excess of this causes the spring to yield and the machine is instantly relieved. The factor of safety throughout is 15, and altogether it is probable that this is one of the most powerful and satisfactory mechanical upsetters ever constructed.



ACME FOUR-INCH UPSETTING MACHINE.

The Canadian Pacific new Imperial Limited, a tri-weekly train making the 2,906 miles between Montreal and Vancouver in 97 hours, was inaugurated June 15 last. The route from Montreal is over the short line to the Central Station, Ottawa, then to Hull over the new Alexandra bridge, into the Ottawa Union Station, and thence westerly. This schedule is all but 30 miles an hour.

A steam railway 40 miles long, the Cincinnati, Georgetown & Portsmouth Ry., is shortly to be converted from steam to electric traction. The Tennis Railway Equipment Co. have the contract.

CONTENTS.

Atchison's Educational Plan.

About a score of special apprentices entered different shops of the Atchison, Topeka and Santa Fe on July 1 to take a course of three years' training in actual work, which will entitle them to be designated as full-fledged machinists. All are young men who graduated from education institutions where the teaching of mechanics is a special feature.

Jacob Miller, Sons & Co., of Philadelphia, have recently purchased, through their engineer, Dr. W. A. Drysdale, a 180-k.w. Westinghouse, two-phase, belted alternator, complete with direct-connected exciter.

INDEX TO ADVERTISEMENTS.

Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XV. 174 Broadway, New York, September, 1902 No. 9

Baldwin Fast Freight Ten-Wheel Engine for the Northern Pacific.

The Baldwin Locomotive Works have lately been building forty Vanclain compound ten-wheel engines for fast freight service on the Northern Pacific Railway. The design of these engines is not exactly new as far as that railway is concerned, but the engines, nevertheless, present some interesting features. The cylinders are 15- and 26-in. by 30-in. stroke, the high pressure cylinder being on top, the driving wheels are 63-in. in dia., and the total weight of the engine is 189,900 lbs. The engine is intended to run and also to pull! The tractive power which will be required. The corresponding spaces on the round-head are occupied by two washout plugs. The tubes are made of steel, No. 13 W. G. in thickness, 378 in number, and 14 ft. 8 in. long.

The front frame splice is a very strong and substantial piece of work, as will be seen in the illustration. The pedestal binders are 2½-in. bolts, passing through the lower ends of the jaws with a cast filler piece between. The valves are of the ordinary Baldwin piston type, and the valve-rod extension bar is bowed up, so as to pass over the forward driving axle, and being attached at its front end to an ordinary up-and-down arm rocker, opened and closed from the cab by two small steam cylinders hung from the lower frame bar, and so placed as to make a "straight-line engine" for that purpose. This arrangement, by doing away with the ordinary ashpan rigging, is economical of space. The air pump is placed on the right side, with the greater part of the air cylinder below the level of the running board, for the purpose of giving the "man behind the throttle" a better view ahead. The headlight is carried on a bracket in front of the smoke box. This arrangement brings the lamp down below the level it would have to be at, if placed on top of the smoke box.

COMPOUND TEN-WHEEL FAST FREIGHT ENGINE.—NORTHERN PACIFIC RAILWAY.

be developed is about 30,380 lbs., and the ratio of tractive power to weight on drivers is 6.25.

The boiler is of the wide fire-box type, with two circular fire doors, and the fuel is soft coal. The crown sheet is radial stayed, and is made in the form of a segmental arch. On each side of the longitudinal center line, three rows of stays are screwed in from below, with heads 9-16-in. thick. This gives six rows with ready formed heads on that portion of the crown sheet which, in case of shortage of water, would be first uncovered. The crown sheet also slopes toward the back head. Two spaces have been left in the flue sheet, for water tubes, or bearers for a brick arch, if such should at any time makes this an indirect connected engine. The arrangement provides for the removal of the leading pair of driving wheels without interference with the valve gear. The back spring for the rear driver is half elliptic, supported at one end by a hanger depending from a saddle of extended double bar form, resting on top of the box. The back end of the spring is also supported in a hanger, and the center of the spring rests against the under side of the upper frame member.

In addition to automatic bell ringer and air-sander, there is one other "parasite," if one may so speak of a useful device. It is, however, a very harmless parasite, being operated by an ingenious piece of steam mechanism. The ashpan slides are

As this engine works over a mountainous country it is equipped with the back pressure brake, as made at the Baldwin works. Its operation is briefly as follows: When the engine is driving forward, the reverse lever is thrown in back gear, the Le Chatelier valve in the cab is opened, which supplies steam to the exhaust passages of the cylinder, and the damper over the exhaust nozzle is closed, air being admitted to the exhaust passages through the inlet valve. The steam is compressed in the cylinders and steam passages, thus retarding the motion of the pistons, and through the medium of the connecting rods, the wheels also. Accumulated pressure may be relieved through a gate valve which is operated by a lever

in the cab, so that the engineer can control the pressure to suit varying conditions. A safety valve is placed in the cylinder saddle to protect the passages against excessive pressure. This device is so arranged as to have the exhaust from the "brake" pass out through a pipe which runs up the side of the smoke box, near the smoke stack.

The engines are simple in construction, and are designed to keep the repair account within close limits, while satisfactorily performing the exacting service required in the movement of what is generally known as "fast freight." Engines of this class can take hold of a passenger train when required to do so, and give a good account of themselves.

As we look at the ample proportions of these N. P. engines we are reminded of the strong contrast to the same, contained in the words attributed in one of Kipling's stories to an outgoing fast freighter, when the latter was referring to the character of the merchandise he was responsible for in service. He was heard to say, deep down in his smoke stack, as "he rolled forward majestically to the turntable and swung like a man-of-war in a tide way, till he picked up his track: 'Costly—perishable—fragile—immediate—that's me! S'long.' "

Some of the principal dimensions of this engine are as follows:

Cylinders, 15 and 26 x 36 in.
Valve, balanced piston.

BOILER.

Type, wagon top. Diameter, 70½ in.
Thickness of sheets, ¾ in.
Working pressure, 200 lbs.
Fuel, soft coal. Staying, radial.

FIRE BOX.

Material, steel. Length, 101 13/16 in.; width, 70⅜ in.
Depth, front, 77½ in.; back, 60¾ in.
Thickness of sheets, sides, 5/16 in.; back, 5/16 in.; crown, ⅜ in.; tube, ½ in.
Water space, front, 4½ in.; sides, 3½ and 4 in.; back, 3½ and 4½ in.

TUBES.

Material, steel. Wire gauge, No. 13.
Number, 378. Dia., 2 in.; length, 14 ft. 8 in.

HEATING SURFACE.

Fire box	173 sq. ft.
Tubes	2,886.3 sq. ft.
Total	3,059.3 sq. ft.

Grate area, 50.94 sq. ft

DRIVING WHEELS.

Dia., outside, 63 in.; center, 56 in.
Journals, 9 x 11 in.
Engine truck wheels, front, dia., 30⅜ in.
Journals, 6 x 11 in.

WHEEL BASE.

Driving, 14 ft 10 in. Rigid, 14 ft. 10 in.
Total engine, 26 ft. 5 in.
Total engine and tender, 53 ft.

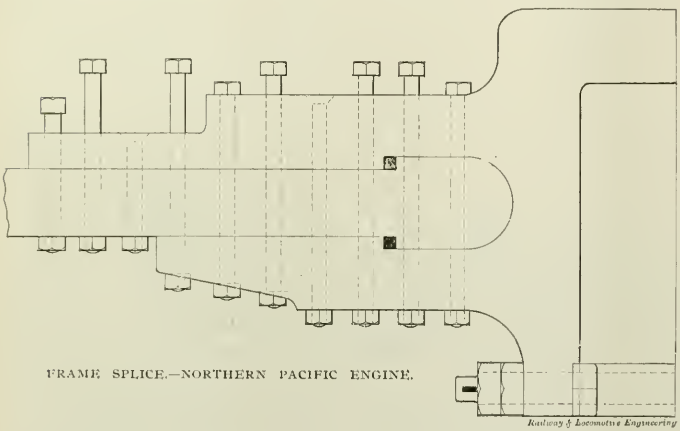
WEIGHT.

On driving wheels	143,300 lbs.
On truck, front	46,600 lbs.
Total engine	189,900 lbs.

Total engine and tender, 289,000.
Tank, capacity, 4,500 gals.

TENDER.

Wheels, dia., 33½ in. Journals, 4½ x 8 in.



FRAME SPLICE.—NORTHERN PACIFIC ENGINE.

Some Personal Recollections.

BY SHANDY MAGUIRE.

Part I—The Attack.

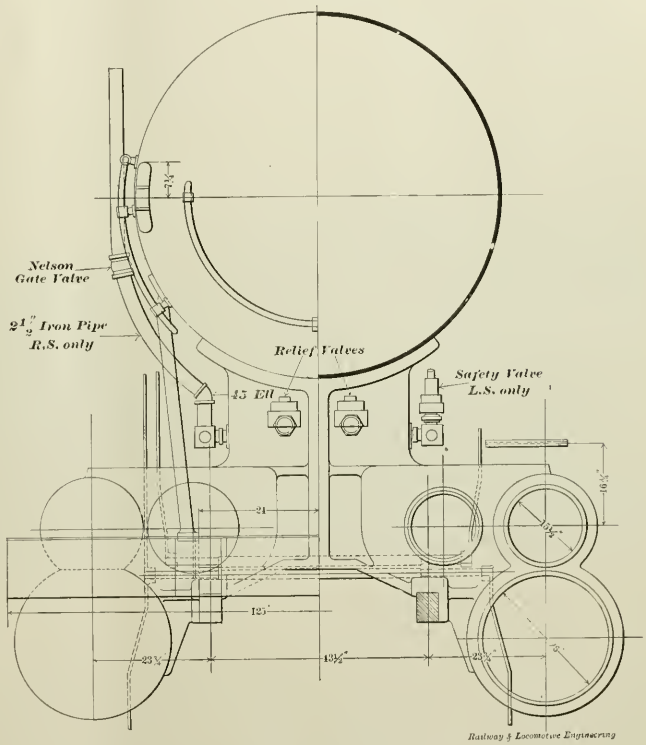
In eighteen hundred and sixty-four I tossed the blocks through the firebox door of the locomotive "Skinner."

I think these lines can be given to the reading public of railroad doggerel as the first gush emanating from a brain supposed to be slightly tainted with what is known as the "divine afflatus." It relates to the calling; and from which brain a vast amount of grist has been ground out since those old days of 'sixty-four. It also gives the date of my first experience tossing blocks. I really liked the work. I "caught on" to how to deck the wood, the sawed end to the push hand, and then with an active fling and dexterous curve, to throw so that the stick would go to the right place and get as close to the flue-sheet as possible. The "Skinner" was a difficult engine to fire. The cylinders were 15 x 24 ins. and the wheels 54 ins. dia. Put about 16 cars of those days behind, then a coach and baggage car, and the stoker did not have much time to admire his beautiful "phiz" in the small mirror in front of his seat; nor to be star-gazing at the houses passing, so as to waft over a little decoction of "maple-sugar moonshine" to the darling in the distance—at least I didn't. I credit myself with the invention of an original conundrum in those days. One day I had poor wood. It consisted of black ash, swamp elm, and wet hemlock. It required the whole vim of two good stalwart arms, well supplied with muscle and willingness, to get in on time. The first man I met was the master mechanic. I had what is known to the nautical boys of the old school as a "bo'sun's nip" in me; and for the benefit of the uninitiated, I may say that a bo'sun's nip is three fingers and a thumb in the glass—many hold the fingers vertical. This lubricated my "jawing tacks," as a sailor would say. I stepped up in front of his royal nibs, and asked him "What is the greatest nonsense in the world?" He appeared to wince a little at the familiarity of a "block-dispenser" having the impudence to "come betwixt the wind and his nobility," much less address him—remember, the Grievance Committee hadn't yet begun to circulate, and "low-downer's impudence" wasn't tolerated so extensively as later on, as it was recently designated to me by a chap whom I know. However, the nip answered the same purpose, and as he knew he couldn't very well get a slave to perform the same duties assigned to me, at the same wages, he condescended to say, "I don't know, sonny; do you?" "Putting a cushion on the fireman's side of the 'Skinner!' "

My engineer at that time was a dear old soul. He has long since been gathered in to receive the reward of "happy-go-lucky - come - day - go - day - God - send-pay-day" boys; boys who are not yet extinct. I loved him. I was young and strong, he going down life's grade. We used to leave Oswego at 8 P. M. daily. We had three hours to go 35 miles and assisted by the great Master Mechanic of the universe, and the dexterity of the block tosser, we sometimes got there. Two thousand feet from the starting point he was snugly cuddled in the arms of Morpheus, and I "monarch of all I surveyed." I loyally poked him in the ribs when it was necessary for him to be awake. We carried no head breakman. I do not remember if we knew what the word meant. A white light was hung out on each side of the coach—our train was a mixed one—so were we—and when the curves were right for his side, he'd look back to see if the cars were all coming, except at night, when I'd look at both sides. The train crew consisted of a baggage man, a conductor, an engineer and fireman. Everything in the shape of mail and small

packages were placed in charge of the baggage man, who was compelled to remain in his car according to the rules, for the protection of the property, and the conductor had to do the switching at way stations. The freight was strewn along promiscuously in the cars, and the only lock or seal was a wood cleat nailed against the door. The fireman and the engineer were then in an organization consisting of two, with the fireman the ranking officer, duly pledged to ascertain what liquids were on the train, so that we could profit thereby. Gin, rum, brandy, wine and other choice stuffs were a godsend to us, and were often sent, about every train. It was my duty to help the conductor to unload at stations. This duty was self-imposed, the corporation conscience then being limited, and only asking the fireman to toss blocks and scour brass at 50 cents a trip of six hours duration. I stood right in with the ticket puncher, who often tossed me a quarter to help me along. In the meantime, I was locating the schnapps, so as not to miss the car, when myself and my partner in thirst would attack it, while waiting for time. The method prevailing for tapping kegs or barrels ere I entered the service on the train was to give a good crack of a coupling pin on each side of the bung. This would make the stave tremble and the bung would fly out. After drinking and filling the "soger," as the canteen was called, those being war times, and canteens numerous, then the bung was restored, and a little dust applied to the wet spots, so as to defy any one to be able to detect the pilfering. I thought the *modus operandi* crude. I applied as much mind to its improvement as a man could do to the improvement of valve motion. I got a small gimlet to let the blood out of the veins of the dearly beloved, and a goose quill that would fill the hole made by the gimlet. I organized ourselves into two committees. I was chairman of the one whose duty it was to locate the nectar, jump in, tap it, take the first swig, leave the quill undisturbed, so that the chairman of the other committee could get down to work, after I'd jump out to relieve him from sentry duty; he'd then fill up and drive in the "spigot," rub a little dust on the spot where the mischief was committed, and we were ready to go, on signal.

One day I searched the train from engine to baggage car to get the "best the house afforded," and I could find nothing but one barrel about four cars back from the engine, marked "old rye." I came to the duke and informed him of the success of my explorations. He was sitting on his seat looking towards me as I came into the cab through the left gangway. If there is a reward, after man shuffles off this mortal coil, that dear soul is enjoying it, and has been for many years. Perhaps, I may see him again in the Great Beyond. If I should, I presume I shall behold his good old comely "phiz" entirely transformed, so as to meet the requirements of the New Jersusalem, ornamented with a most seraphic smile. I shall hope so, and if such a consummation so devoutly to be wished dawns upon my vision, the first chat we shall hold after the "how-do-ye-do," I'll tell him of the old woe-begone, miserable and heart-rending look of disgust he wore on his face that day, when he heard there was nothing to be had but the barrel marked old rye, as he replied: "Well, when all fruit fails, welcome haus. Take the 'soger.'" With my usual alacrity I jumped into the car, and inside ten seconds I had a hole in the right spot, the quill inserted, and my mouth in loving clasp over it. Talk about tight joints on pump-pipes! Why I believe the most perfect vacuum ever discovered existed between my mouth and the liquid in that barrel. I made a mighty suck. There was no time for fooling at that business, and it required expedition, so as to not be caught entering the car either by the station agent, the baggage man or the conductor. So rapidly had the stuff to pass into our stomachs, that the first swig was landed there, and the next one on its way, before taste took hold. It was so with me on that occasion. The first gill of a swig had passed down and the next a close second, when I made a jump out of the car, landed on the ground, gagging as furiously as a jackass preparing to bray. My partner then got a "gait on him" to vault into the car, but ere doing so, turned a look on me, who was yet speechless and gagging on the ground, and said: "Well, by Jove, it must be great stuff when it makes you shake your head that way." He performed about the same contortions I did, in less than half a minute; and about the time he flopped on the ground, I had recovered my speech sufficiently well to ask him if it was kerosene, or did he think it was lard oil.



BALDWIN BACK PRESSURE BRAKE—NORTHERN PACIFIC.

In a future issue of RAILWAY AND LOCOMOTIVE ENGINEERING I shall relate to you, gentle and patient reader, how the fluid we gulped down from the barrel assimilated with an official dose administered to us a few days later by our holy terror of a superintendent.

(*To be continued.*)

We have ready for delivery Sinclair's new book on "Firing Locomotives." It is a convenient book for the pocket, contains plain instruction on combustion of fuels and costs only 50 cents.

Proportions of Locomotive and Stationary Boilers.

Common questions which come to this office relate to the horse power of locomotive boilers and of stationary boilers. A stationary boiler with natural draft is allowed 34 sq. ft. of heating surface to supply steam for one horse power. A locomotive boiler is not designed with any special view to the developing of certain horse power, but to supply steam for cylinders of a certain size, but there is a fairly uniform relation between the power of a locomotive and the boiler.

The following notes about locomotives and stationary boiler proportions are taken from a paper read by Mr. J. A. Carney, M. M. of the C. B. & Q. at a meeting of mining engineers:

A locomotive boiler with a shell 60 in. in dia., tubes 12 ft. 4 in. long, and a 9 ft. fire-box, has a heating surface of 1,689 sq. ft., and develops 1,000 horse power when doing maximum work. The evaporating surface is 96.5 sq. ft. Therefore 0.59 horse power is developed per square foot of heating surface and 10.3 horse power per square foot of evaporating surface. On the other hand a stationary boiler with a shell 66 in. in dia. and 18 ft. long, has a heating surface of 736 sq. ft. and develops 100 horse power. The evaporating surface is 84 sq. ft. Therefore, 0.13 horse power is developed per square foot of heating surface and 1.19 horse power per square foot of evaporating surface.

The ratio between heating surfaces of stationary and locomotive boilers per horse power is, therefore, stationary: locomotive = 4.36:1. And the ratio between the evaporating surface per horse power is stationary: locomotive = 7.70:1. In other words, a stationary boiler has 4.36 times as much heating surface per horse power for making steam, and 8.70 times as much surface per horse power for the escape of the steam after it is made as a locomotive boiler. Since foaming is determined by the rate of formation and the escape of bubbles of steam, it will readily be seen that a stationary boiler with 8.70 times the evaporating surface per horse power will run successfully on a quantity of alkali in the water that would render the locomotive boiler useless.

Mean Effective Pressure.

In a short article on the subject named above, Mr. W. W. Edwards makes an interesting point in the pages of *Science and Industry*. M. E. P. is generally defined as the average of all the varying pressure on one side of the piston, minus the average of all the back pressure that is exerted on the other side. It is usually computed by dividing the area of the card by the length and multiplying by the scale of the spring. It may also be found by dividing the card into any number of equal parts, and taking the average lengths of the ordinates erected in the middle of each of these divisions; this average multiplied by the scale of the spring gives the M. E. P. In any card the pencil line made up of the steam, expansion and exhaust line represents, to some scale, the varying pressure on one side of the piston during one stroke, while the back pressure line on the card really represents the pressure on the same side of the piston during the following stroke, and not, as generally assumed, the back pressure on the opposite side of the piston during the same stroke. The back pressure retarding the piston during No. 1 stroke is not shown on the diagram made for that stroke, but is represented by the back pressure line of another card. Two indicators, one at each end of the cylinder, are necessary for taking cards from which the M. E. P. is to be accurately calculated. The variation of load or of conditions, however, is so small from half revolution to half revolution, that the diagram of one stroke may be paired with the diagram of the one immediately following, for all practical purposes.

The writer gives two diagrams, one with comparatively large area, where the M. E. P. is reduced 55 per cent. by a cramped exhaust at the other end, causing considerable back pressure, and the second diagram, that of the following stroke, with small back pressure, gives a M. E. P., in which the usual method of computation would have given an error of 36 per cent. too little. In both these diagrams the actual back pressure is used. When the two cards are simultaneously taken the errors just balance, because in the summation of the M. E. P. of the cards, it makes no difference in the final result whether the back pressure of the cards was taken from the mean pressure of the card on which it appears or from the other diagram.

Enormous Iron Production.

The United States is fairly running away from the rest of the world in the production of iron and steel. For the first half of the present calendar year, the production was 8,803,574 tons, an increase of 1,130,000 tons, or 14 per cent. over the same period a year ago. A noticeable feature about the industry is that it has made this wonderful increase in the output while the export of iron and steel has very considerably fallen off. The decrease in iron and steel export the last fiscal year is placed at $20,000,000. So enormous and rapid has been the growth of the home demand, that it not only offset the partial loss of the foreign markets and the huge increase in domestic supplies, but also drew heavily upon what may be called the home reserve supply.

New Grand Trunk Railway General Offices in Montreal.

The Grand Trunk Railway officials lately moved into what may be described as one of the finest buildings of its kind in America. The company's offices were formerly situated at Point St. Charles, an outlying portion of the city of Montreal, and one of the reasons given for this location is that the then general manager, Sir Joseph Hickson, thought that people who did not have any important business with the company would not take the trouble to go to Point St. Charles, and so the uninterrupted work of the employees would result in a practical economy of time, but of course in those days local competition did not amount to much.

The building is constructed of Bedford, Ind., limestone, resting on a base of Quebec granite. The polished pillars, which are a feature of the front, are also of Quebec granite.

The vestibule is one of the handsomest entrances to a public building on the continent and is composed of four kinds of rare marble; the lower portion of the vestibule being of black and gold marble from Italy and green marble from Greece; the rose tint marble is from France, and the large panels were brought from the south side of the Pyrenees Mountains in Spain. The three panels between the doors at the head of the steps are of a very rare species of marble from Nubia, Africa. They are composed of variegated colors of bright hues and are a most interesting study, while the panels on the sides are beautifully marked.

The vestibule is decorated with tile work from Gloucester, England, and is a magnificent piece of work, being glazed porcelain, embellished with embossed designs which give the appearance of Italian Majolica. The *tout-ensemble* is a work of great beauty.

The building is modern in all its appointments, being equipped with high speed elevators, and the Sturtevant ventilating fans, which will be found a great boon in the summer, as these fans, when working, will distribute cool air throughout the building; and in the spring and fall they can be utilized to distribute hot air when necessary to take the chill from the atmosphere on raw days when the steam heat would be more powerful than that required.

An idea of the increase in the business of the railway may be had when it is stated that in the year 1880 there were in the general office 299 employees to look after the business of 1,312 miles of road, while today 550 attend to the working of 4,197 miles. This means that formerly there was on the average one employee to 4.38 miles of road, while now there is one to 7.63 miles.

The will to do well is the next thing to having the power.—*Martin Chuzzlewit.*

The Hayes Ten-Wheel Camel.

BY C. H. CARUTHERS.

Having realized the efficiency of the Winans camel engines, the master mechanic of the Baltimore & Ohio Railroad, Mr. S. J. Hayes, in 1853, designed and placed in service on that line a type of camel engine supposed to be better adapted to regular service on the freight trains of the road. These engines differed from the Winans camel in having shorter fire-boxes; three pairs, only, of drivers, 50 in. in dia.; a four-wheel truck, and cylinders placed at a slight angle. The dome was placed on the middle sheet of the boiler barrel, and was surmounted by a pair of "buckhorns," having a safety-valve on each horn and the whistle between; a type of mounting used on nearly all the Smith and Perkins engines, and also on some others used by the Baltimore & Ohio R. R. The dome of this Hayes camel-type was much smaller than that of the Winans camel; made so, probably, to overcome a weakness shown in some Winans boilers at that point.

The valve-gear was originally of a type similar to that used by Winans; although a drawing is in existence which shows one of these engines with a double-deck steam chest, having what is evidently an independent cut-off valve on the top of the main valve. The parallel rods were fitted with straps, keys and split brasses.

The writer cannot say positively whether the frames of these engines were originally extended to the rear of the fire-box, but all coming under his notice were so arranged, and their appearance rather indicated original construction in that manner. These frames were of bar type to the front of the fire-box and then changed to a slab of about 8 in., as in the Smith and Perkins engines, and were united behind the fire-box to a cross frame containing the draft attachments similar to a consolidation engine of today.

The pumps were of the B. & O. type—one on each side of the fire-box and driven from return cranks on the ends of the pins in the rear drivers. The tenders were of the same type as those used with the Winans camels after the "chutes" were removed, having a long "firing pit" at the front, and on some, protected by a roof.

The cabs were of the type used by the B. & O. on all camels, having glass windows in the sides instead of canvas curtains, as originally used by Winans on his camels and retained by most of the other roads using those engines.

These Hayes camels also had the boiler barrels covered with lagging of wood and this in turn by Russia iron secured by bands of the same material.

The first of these engines was B. & O., No. 138, built by A. & W. Denmead & Sons, of Baltimore, Md., and was placed on the road in May, 1853.

Quite a number were built for the B. & O., and one for the Northern Central Railway, and then for some reason the construction ceased, but was revived later by John C. Davis, who built quite a number in the early '70s. Many remained in service until within very recent years.

The photograph from which the illustration was made, was taken from B. & O. engine No. 160, in 1894, while in regular service in the yard at Benwood, W. Va.

This engine, as will be observed, had been somewhat modernized, having link motion, injector, straight stack, etc., but yet gives a very good idea of the general appearance of these engines as originally built.

According to B. & O. records, some of these engines were also built at the New Castle Locomotive Works, Wilmington, Del.

Their principal dimensions, as nearly as can be ascertained, were as follows:

Cylinders, 19 x 22 in. Driving wheels, 50 in. dia.
Flues, 134; 2¼ in. dia. Fire boxes, 42 x 60 in.
Weight on drivers .... 53,800 lbs.
Weight on trucks.......................... 17,200 lbs.

Total weight.......................... 71,000 lbs.
Weight of tender loaded, 56,000 lbs.
Working pressure, 120 lbs.

HAYES TEN-WHEEL CAMEL.—BALTIMORE & OHIO RAILROAD.

The Oldest and the Newest.

A strange contrast is offered by the oldest and the newest locomotive in the world. The former, built by Stephenson in 1822, is now, after 80 years' continuous service, still working, hauling trucks at Hetton in England. The principal dimensions of this "old timer" are: Diameter of the cylinders, 10¾ in.; piston stroke, 24 in.; diameter of the wheels, 3 ft. The weight of the engine is 15 tons, and it has a haulage capacity of about 129 tons at a speed of 10 miles an hour on a fairly level track. Its general design (excepting the cab) remains as originally constructed, while some parts, notably the steam dome, are actually portions of the engine as constructed in 1822.

After this long and faithful service it is not surprising to learn that the engine is at last becoming unequal to the ever-increasing demands made upon it, and the directors of the Hetton colliery, therefore, shortly intend to withdraw the relic from Hetton, and it will in the course of a few weeks find a permanent "resting place" at the Durham College of Science, Newcastle-on-Tyne, where it will be preserved to this and future generations as a worthy example of the earliest period of locomotive engineering. Stephenson's "No. 1. Locomotion," built for the opening of the Stockton and Darlington Railway in 1825, continued working on "the first public railway" until 1850, when it passed into the hands of Messrs. Pease and Partners, by whom it was used for colliery purposes until 1857, at which time it was placed on a pedestal for exhibition at Darlington

Station, where it is to be seen to-day.

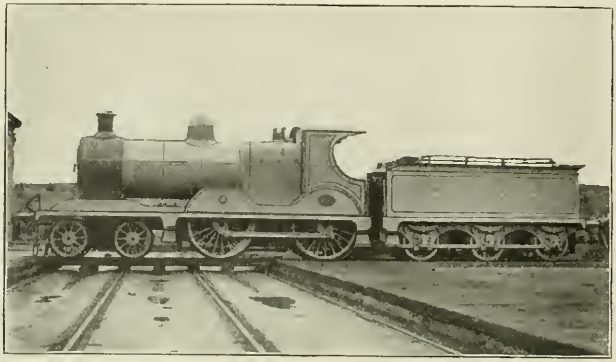
The newest locomotive may be said to be the New York Central tandem compound, No. 2399, built recently at the Schenectady Locomotive Works. A few days ago it took a train of 108 loaded cars from De Witt to Albany in 11 hours. The 108 cars were loaded with 4,500 tons of freight. It also drew 50 loaded cars up the Schenectady hill without assistance.

FIREBOX.

Type, Belpaire. Material, copper.
Length, 6 ft. 3 in. Depth, 6 ft. 10½ in.
Width, 4 ft. 4½ in. Grate area, 20 sq. ft.

No. 2 is one of two good engines recently purchased from Kitson and Company, of Leeds. They are magnificent machines and can easily handle within reasonable limits as many wagons as can be strung behind.

Cylinders, 17 x 24 in.
Driving wheels are 5 ft. 2 in. diam.



IRISH EIGHT-WHEEL ENGINE.—M. G. W. R.

Irish Engines.

We are indebted to Mr. E. L. Clough, of Dublin, for information concerning these two Irish engines. The first is an eight-wheel locomotive, the latest passenger machine on the Midland Great Western Railway. She is just out of the Broadstone Shops and is said to be the largest engine in Ireland and the first passenger engine to have a Belpaire fire-box. This class of engine, of which there are to be four, was designed to pull a heavy corridor train from Dublin to Galway, 126 miles, in 3½ hours. Owing to numerous stops and severe curves and gradients high speed has to be maintained.

The engine has two Gresham and Craven injectors and steam sanding device; automatic vacuum brakes to coupled wheels and six wheels of tender.

The principal dimensions are as follows:

Cylinders, 18 x 26 in.
Slide valves placed between the cylinders and operated by Stephenson's link motion.

WHEELS.

Drivers, diameter, 6 ft. 3 in.
Bogie, 3 ft. 6 in. Tender, 3 ft. 6 in.
Tender carries five tons of coal and 3,000 Imperial gallons of water and is fitted with water gauge.

Weight on drivers..........	17 tons	18 cwt.
Weight on trailers.	15 tons	18 cwt.
Weight on bogie............	16 tons	15 cwt.
Weight on tender..........	35 tons	16 cwt.
Total................	86 tons	7 cwt.

BOILER.

Diameter, 4 ft 10 in.
Length, 11 ft. 3 in. 235 brass tubes.
Pressure 180 lb. per sq in.

Heating surface in tubes......... ...	1,213 sq ft.
Firebox	150 sq. ft.
Total........................	1,363 sq. ft.

Weight on leaders...........	13 tons	8 cwt.
Weight on drivers	13 tons	11 cwt.
Weight on trailers...........	11 tons	14 cwt
Weight of tender in running order...............	27 tons	8 cwt.
Total.................	66 tons	1 cwt.

BOILER.

Diam., 4 ft. 2 in. Length, 10 ft. 3 in.
Heating surface tubes, 873 sq. ft.
Heating surface firebox, 108 sq. ft.
Firebox has 17 sq. ft. grate area.

IRISH GOODS ENGINE.

A press dispatch from "up State" says that the New York Central's new tandem compound, No. 2399, built at the Schenectady Works, took a train of 108 cars containing 4,500 tons of freight from De Witt to Albany in eleven hours. Some idea of the size of the load can be gathered when it is realized that 9,000,000 pounds of freight were moved.

Smoke Abatement, Abated.

In the course of an agitation recently carried on against the smoke nuisance in cities caused by the burning of soft coal in furnaces, the statement was frequently made that gas could be burned as fuel nearly as cheaply as coal. We cannot see how this can be true. About thirty per cent. of the heat of the fuel is lost in converting it into gas. How the gas fuel can produce as much heat as the coal it was taken from is an assertion that will not be accepted as gospel by the sensible men who comprise the engineering fraternity.

There was once existing in England an organization which was called the Smoke Abatement Society. Like all one-idea societies this one was celebrated for its intolerance towards smoky chimneys and to all furnaces that failed to consume their own smoke. This society prepared to disseminate its principles by means of a smoke abatement exhibition which was held at South Kensington, London. The principal exhibits were patented smoke-preventing furnaces. Some of them did not seem to work satisfactorily when they were on exhibition, for the local authorities prosecuted the society for creating a smoke nuisance, and the managers were fined.

When Our Coal is Done.

In our July issue we referred to a letter written by Prof. John Perry in *Nature*, in which he pointed out that the consumption of coal in the world is increasing yearly, and that the best engines to-day utilize less than 10 per cent. of the energy set free in the burning of coal. He therefore thought something ought to be done to reduce this enormous waste.

When all our coal has been burned or wasted its place may, according to Mr. D. E. Hutchins, of Swellendam, Cape Colony, be supplied by wood. Mr. Hutchins, who is a forest officer, replying in *Nature* to Professor Perry, shows that in the warmer latitudes of the earth, such

as Australia or South Africa, the eucalyptus will produce 20 tons of wood per acre, "which has an equal or higher thermal power, bulk for bulk, than coal."

This statement will surprise most readers. The world's yearly output of coal is 630,000,000 tons; its output of wood is thirty times as large, and, it is said, could be made 120 times as great.

English Flyers.

Last month we presented two pictures of the twenty-hour trains between New York and Chicago—the Pennsylvania Special and the Twentieth Century Limited on the New York Central. These trains were photographed while passing at full speed. On this page are presented two English flyers, also "caught in the act" of rushing past the camera at full speed. One of these, on the Midland, is drawn by an ordinary eight-wheel engine and consists of seven coaches. The typical English hedge which forms an almost impenetrable fence along the railway track may be seen on the left side of the illustration, the perspective of the picture showing it just about the level of the chimney. We allow ourselves to use this word instead of smoke stack, as we are now writing of English engines. The Scotch Express on the Midland runs via Leicester, Leeds, Settle and Carlisle, from which point the North British Railway takes the train to Edinburgh. The distance is about 404 miles, and is run in somthing over 8½ houras.

The other photograph is of the Great Northern Express, taken while passing Hornsey, a suburb of London. The engine "working" this train is what we would call a 4-2-2 type, but in the United Kingdom it would be described as one of the Great Northern "singles." The train consists of four coaches. In looking closely at this picture it is interesting to observe how the steam, as it leaves the chimney, is momentarily kept from condensation by the stream of hot gas which rushes out with it, but as the cool air strikes it, condensation takes place, and forms the fleecy cloud which hangs in the air above the train.

SCOTCH EXPRESS, NEAR HENDON.—MIDLAND RAILWAY

GREAT NORTHERN RAILWAY EXPRESS PASSING HORNSEY.

Power Brakes Are Used On Street Cars.

A committee appointed by the Board of Public Improvements, St. Louis, Mo., to investigate the advantages of power brakes, recently reported on the subject. The committee visited Pittsburg, Washington, Philadelphia, New York, Boston, Buffalo, Chicago, Milwaukee and Indianapolis, in all of which, with the exception of Washington, they found street car power brakes of various designs more or less in use. The report says: "Your committee found that 12,000 power brakes are in every day service, and have been in such service for from two to six years; that the street railroad companies now using these brakes have put them on voluntarily; that the number and especially the severity of street car accidents is materially reduced by the adoption of these brakes; that the regularity of the intervals of time between cars is more easily maintained and the daily mileage of each car is greater when equipped with these brakes; that first cost is repaid within three to five years by reduction of expense for accidents." The committee, from practical experience, found that the average distance required to bring a car to rest in emergency cases, was as follows: Running at 15 miles per hour, within 30 ft.; running at 8 miles per hour, within 8 ft.; running at 4 miles per hour, within 2 ft.

Asbestos.

Asbestos is used so much for lagging the boilers carrying very high pressure and therefore very hot steam that all persons connected with locomotives are becoming familiar with the appearance of this material, but few of them understand what it consists of; they only know that it does not burn or char when subjected to intense heat, heat that would melt or burn up almost any other substance. Asbestos lagging supplied by the Franklin Manufacturing Company can be made red hot without showing any signs of oxydation, which is the process of burning.

Asbestos is a product of nature and is a silicate of magnesia. A common form contains 59.75 parts of silica, 21.1 parts of magnesia and 14.25 parts of lime. The coloring comes from protoxide of iron. A writer in the New York *Evening Post* says:

"There is probably no production of inorganic nature about which there is so much popular mystery and misconception as asbestos. It is vaguely understood that the principal claim of this remarkable product to attention is that it cannot be consumed by fire, and not in-

frequently the effect of the mention of asbestos is to carry the hearer back to the days when the people of the Pharaohs wrapped their dead in cere-cloths woven from the fiber, in order to preserve them, the body having been first embalmed. Romantic stories have also come down to us of ancient demonstrations of magic in which asbestos has played the leading part, but the real interest in asbestos centers in the present. It is of more importance to the human race to-day than it has been in the whole range of history.

"Asbestos has been found in all quarters of the globe. It comes from Italy, China, Japan, Australia, Spain, Portugal, Hungary, Germany, Russia, the Cape, Central Africa, Canada, Newfoundland, this country, and from Southern and Central America. The asbestos generally found in the United States, especially in Virginia, the Carolinas and Texas, also in Staten Island, New Jersey and Pennsylvania, is in appearance like fossilized wood.

"Notwithstanding this wide distribution of asbestos, the only varieties which at present appear to demand serious consideration, from a commercial point of view, are the Russian, the South African, the Italian and the Canadian. The principal claim possessed by the Russian fiber to a place in this quartet is based on the enormous extent of the deposits which have been discovered in East Russia, beyond the Ural mountains, and Russian Siberia. So far their specimens have been of comparatively poor quality. The yield is used almost entirely in Europe, where it is mixed with the Canadian for spinning, making paper and other purposes where an inferior grade can be utilized.

"Before the development of the Canadian fields, the Italian asbestos was supreme in the market. For nearly twenty years Italy has been looked to for the best grades of the fiber. But the Italian asbestos industry, once so important, is already on the down grade. The difficulties of mining are very great, and unduly increase the cost of production. The asbestos itself, judged by the latest standards, is of inferior quality; it is not easy to spin, and it does not pulp well in the making of paper. As a matter of fact, Canada contains the great asbestos region of the world, in the sense that while its mines are practically unlimited in productive capacity, the product is of a quality which fully meets the requirements of the newest and most exacting of the innumerable uses that are daily found for it."

Horse Power of Boilers Indefinite.

One horse power is defined as the raising of 33,000 pounds one foot high in one minute, or its equivalent. When the term horse power is applied to a boiler which simply generates steam, the term loses its original significance and becomes very vague. This subject is not new, but attention has been again called to it by a writer in one of the scientific magazines. The writer very truly remarks that the term horse power applied to steam boilers conveys to many minds something concerning the size of the engine the boiler is capable of supplying with steam. To other minds, and we believe to the great majority, it has practically no meaning and suggests no idea of the real capacity of the boiler for generating steam. This is because different engines take different quantities of steam to develop one horse power. The rule for calculating the horse power of boilers is not a hard and fast rule as shown by this writer, who tells the story of two perfectly honest agents who, having boilers of 700 and 670 sq. ft. of heating surface respectively, used 12½ sq. ft. and 10⅓ sq. ft. as the unit of surface equivalent to one horse power each for his own boiler, and by so doing offered to a prospective buyer a 55 horse power and a 65 horse power boiler. The nominally larger boiler of the two turned out in practice to be the smaller, with unhappy results to the buyer. He tells us that the average steam consumption of single-valve non-condensing engines is about 30 pounds per horse power; four-valve engines, 26 pounds; compounds, 22 pounds; for condensing 15 per cent. less. The way it may work out is shown by the following example: An engine of 100 horse power using 30 pounds of steam per horse power will require a boiler capable of evaporating 3,000 pounds of water per hour. If the engine only required 22 pounds, the boiler could furnish $3{,}000 \div 22 = 137$ horse power. In the first case the boiler looks like a 100 commercial horse power, and in the second case one of 137 horse power. The term horse power as applied to boilers seems like saying that a bookcase will hold 150 books, without specifying whether paper-covered dime novels or volumes of the Encyclopedia Britannica are on the shelves.

Shop Leaks.

The topical discussion at the recent M. C. B. convention on meters for stopping leaks in car work expenses, was opened by Mr. G. W. Rhodes. Mr. Rhodes always believes in looking after little things. By so doing one may help in solving large problems. Cases were cited in the discussion, of lighting headlights early in the afternoon; the waste of gas in the passenger cars; nuts, bolts and screws found around the floors of shops, and to the fact that the full amount of work was not always obtained from shop machines. Where this is the case it is clear the meter is somewhat out of order and employees are not as watchful as they should be. Such leaks do exist and in the aggregate probably equal a large leak. Possibly the education of shop men is the way to stop these small leaks, and by making them feel the importance of their own department, by stimulating discussion among men regarding the work which they are doing, and by having them organize local associations, is one way in which problems may be solved. Such associations throughout the country would be of as much importance as the Master Car Builders' Association itself. If these smaller associations should solve this, or similar problems, the work of the older and larger association would be correspondingly lessened.

New Steel Molding Process.

The steel casting industry has made wonderful strides within the past decade. One who has contributed in no small degree to its advancement is Mr. Frederick Baldt, Sr., general manager of the Penn Steel Casting Works, Chester, Pa. For months he has been engaged in developing ideas that have resulted in the introduction of a new system of steel molding. Patents were recently issued to him, covering a process that will simplify the molding of steel. The method consists in first making a master mold from any pattern and then casting from this as many fusible patterns as may be required. The fusible pattern is put into an iron box of suitable size, after which the box is filled with molding sand and is run into the drying oven, where the fusible pattern is melted out. The casting is then made from the dried mold. An important feature of this process is that the sand is conducted and driven by compressed air into all parts of the box. The castings are absolutely seamless and without fins, and no chipping is required afterward. The process is particularly applicable to the casting of interlocked articles.

The Metric System.

The bill providing for the adoption by the United States of the metric system has failed of consideration through the delay on the part of the Committee on Rules in setting a special order for its discussion. The committee was favorably disposed toward the bill, and had promised that the Committee on Coinage, Weights and Measures would be granted a day for the consideration of any measures it might bring forward. This pledge was made at the time when it was expected that Congress would remain in session until the middle of July to consider the Cuban Reciprocity bill. The metric system bill might have been taken up under an order known as "suspension of the rules," but as it would then have been required to be put to a vote without debate, its friends were unwilling to assume the risk of its defeat without the opportunity of explaining its operation to the House.—*Iron Age.*

General Correspondence.

What Ailed This Engine?

Mr. O'Neil does not say if the engine would make more than one exhaust before blowing in the forward motion, but when in the back motion, with the engine on the center on the right side, steam would blow straight through the valve, in which case the left front bridge would be broken, and steam would pass through the break into the exhaust passage, and when the lever is moved to the front corner the blow would cease. F. L. D.

Point of Suspension of Expansion Link.

My only excuse for writing upon such a subject as the point of suspension of the link is that I have discovered something so entirely at variance with everything I have read on the subject that it may prove as much of a surprise to many of your readers as it was to me.

In every work I have ever read which discussed the location of the point of suspension of the link, the author has assumed, at the outset, that this point is placed inside the link arc in order to rectify the error due to the angularity of the main rod.

Recently, however, I had occasion to make a very careful analysis of a link motion, and during the course of this work laid down the motion assuming a slotted crosshead or Scotch yoke as a substitute for the main rod. To my infinite surprise, I found that the point of suspension necessary to produce an equalized cutoff at both ends of the cylinder, instead of being much farther inside of the link arc, was almost over it. This discovery led me to make a further investigation which developed the following facts:

If either the angularity of the main rod or that of the eccentric rods be considered separately, the point of suspension of the link necessary to produce an equal cutoff at the two ends of the cylinder will in each case be outside the link arc. Further, if these two irregularities be considered together and separate from any other, this point will assume a position outside the link arc and at a distance equal to the sum of their individual corrections.

On the other hand, however, if the irregularity consequent upon the offset of the eccentric rod pins be considered alone, it is found to be rectified by placing the point of suspension inside the link arc and at a distance considerably greater than the sum of the two just mentioned are outside.

The resultant of the three corrections, then, places this most troublesome point in the position where it is universally found, somewhat back of the link arc.

Hempstead, L. I. C. A. Crandell.

Cars of No Capacity.

In the Gilbert and Sullivan opera of "Iolanthe," the Right Honorable the Lord High Chancellor points out to two peers of the realm that he had, as a lover, been compelled to apply to himself as chancellor, for the hand of his own ward. He had, he said, been acting in two capacities. The peers were very thankful, they told him, that they were persons of no capacity whatever. On railroads also we have cars which occasionally act in two capacities. For instance, we have the handy car, which, as a box car, can make an exemplary record, while for rough freight it may even rival the gondola. We have box cars which may have perfectly level floors at one time, yet can be converted into hopper bottomed cars on short notice. The J. G. Brill convertible summer or winter street car can act in two capacities with all the ease of the Lord Chancellor himself. Candor and honesty, however, compel us to acknowledge that on railways there are also to be found cars of no capacity whatever—simply because it is not stenciled on them, as it should be, and again, candor and honesty force us to say that nine times out of ten these cars belong to private lines.

Now for a moment imagine what may at any time happen and what has actually taken place, with cars of "no capacity" on a railway, and judge if it may not some day be worthy of representation on the stage in comic opera. A car inspector is solemnly given a book of rules sanctioned by the M. C. B. Association, in which it is stated that all cars must have capacity stenciled on them. Furthermore, a table connecting capacity with size of axle is before him, and he sallies forth to inspect "for safety only." One fine day he comes across a car of "no capacity." He cannot stop it, because it contains important rush freight. He can't tell if the axles are too light for the capacity of the car and he lets it go because he can't do anything. Eventually an undersized axle breaks and wrecks the train. The railway company then has on the debit side of its ledger a blocked line, the expense of a wrecking train, cars damaged, track damaged, paying load damaged, cost of transfer of load in disabled cars, loss of time all round and a general disorganization of traffic. But stop, gentle reader, the railroad company has one inalienable right conferred upon it, by this very wreck, which gives one item to place on the credit side of the ledger—they can charge the owners for replacing one axle which has failed under fair usage; all the rest of it is simply consequential damage. It is just as if, after your house has burned down, you find ten cents in the ruins. But, by the way, was that a failure under fair usage? Yes, certainly it was—in the Gilbertian sense. The railroad had not run the car over cobble stones, or nicked the axle with a cold set. They had simply not inspected the car intelligently, because, under the circumstances, that could not be done.

The car owner comes right up to the footlights and sings, "Don't look at my freight cars as they go by, but if they cause a wreck, you will get it in the neck, and the axle I will pay for by and by." The railroad chorus in the background replies, "That's because they are cars of no capacity whatever," while the laughter and applause from boxes, gallery and orchestra chairs, becomes simply uproarious, because it's comic opera, don't you know, and not a hard, serious business transaction in which hundreds of dollars are involved, and men with reputations take part.

The thing to remember is, that if the railroads applied a simple remedy, which they have in their hands at the present moment, and which would not delay trains or cost them anything, the whole of the comic opera aspect of the thing would disappear as if by magic.

If cold, hard, soulless railroad corporations, "working for their pockets all the time," ever arrange to stencil capacity on all cars now running without such stenciling, and to charge the neglectful owners with the cost of doing it, why, the bottom drops out of this kind of comic opera for all eternity, and you wouldn't get the price of an undersized wreck-producing axle in a month of Sundays. The M. C. B. Association can do the whole thing by passing one resolution. They may easily and at any time act in a new capacity and do away with "no capacity" cars on railroads.

Rockballast.

The Care and Management of the Locomotive Boiler.

The boiler is the vital part of an engine, being the source of power and on its integrity rests a most important factor in the business of all steam railroads. In view of this nothing should be left undone in its proper care and management. When we come to consider the vast amount of water which is evaporated in a boiler holding from 1,700 to 2,000 gallons, in a round trip, using four or five tanks of water, each containing from 3,500 to 5,000 gallons, and when we remember that each gallon contains from 20 to 30 grains of solid matter, which re-

mains in the boiler, it will be seen how great is the problem of keeping the interior of the boiler free from scale and deposit. When a steamship arrives in port her boilers are washed and scaled and her flues are cleaned, under the careful eye of one of the engineers. The stationary engineer and fireman at the end of each week or perhaps two weeks, let their boiler cool down and carefully wash it, scrape and clean the flues, fill it, and get it ready to fire up again. These men know the great benefit this care is, both to themselves and their employer; they know the saving in fuel which they can effect, and as a rule, they try every means in their power to do it. Some years ago the locomotive engineer and fireman used to see that the boiler was properly taken care of, as there were several hours in which the boiler was cooled down, washed out, flues cleaned and boiler filled and fired up again. It is different to-day; when engines arrive after their trips the men have to seek their much needed rest and another engineer and fireman take charge of the machine to make another trip. The boiler may need washing out and flues require cleaning, and then comes the hard struggle to get over the road, and none but the enginemen know what it is to make time or try to make up lost time with the steaming qualities of the engine very much impaired by the fact that the water in the boiler is in a filthy condition, and with from 50 to 150 flues rendered useless by being stopped up. The flues of a locomotive stop up very quickly; it often takes several hours to properly clean the flues of one engine. With my flexible flue cleaner an engine can have her flues cleaned in from 10 to 30 minutes, either with the fire in, or dumped out. There is no longer any excuse for allowing flues to remain stopped up. When we come to figure out the lost heating surface of 50 or 100 flues that may be stopped up, we can see the great advantage of having them clean. If the bottom flues are allowed to remain stopped up the water circulation will be sluggish and sediment will settle around them. If they are kept clean, as they should be, so that ebullition can take place in the lowest part of the barrel of the boiler, the sediment will be kept stirred up and will be precipitated in the boiler legs where it can be washed out. Then again, when the "boys at the scoop" have to work to generate steam through 1-16 or ½ in. of scale that intervenes between the heating surface and the water, we can see why their task is so laborious. That means so much more coal consumed in a given time, and it also means imperfect combustion as the fire must be forced to keep up the required amount of steam. According to our best authorities, a scale of 1-16 in. in thickness will require an expenditure of 15 per cent. more fuel than if it was not there, and this ratio rapidly increases as the scale thickens. Thus when scale is ¼ in. thick, 60 per cent. more fuel is required, while when it is ½ in. thick 150 per cent. more fuel is needed. We can easily see the great necessity for keeping the boiler and flues clean and the advantage is also apparent of having engine ready for train two or three hours sooner than by the old way. My boiler washer, filler and my flexible flue cleaner when used, a first-class job can be done in from 1½ to 2 hours This is a great saving of time and at least half a ton of coal can be saved per hundred miles. I have proved this by keeping my devices on one engine for six months, that is, the boiler washed once every two weeks, and the flues cleaned twice or three times per week, the engine making 200 miles a day, and as she had two hours in the roundhouse, there was no need for another engine to take her place, the work being done so quickly. My device is made to connect with both injectors of a dead engine and to one injector of a live engine on the next pit, then wash-out plugs are taken out of the dead one and the device is started, thus keeping up a rapid circulation of water as it leaves the boiler; this does not allow sediment to settle and bake dry on flues and sheets, which is so hard to remove. If mud is very thick in the boiler legs, a ½-in. pipe may be inserted under the mud and steam turned on, to tear the mud up, while water flows in to wash it out. This does away with the old, slow scraping process, and men getting wet using the scrapers. This method effects a great saving in stay bolts, seams, braces, and keeps flues from leaking, as the boiler is allowed to cool down only a very little; in fact, the change is hardly perceptible to the hand.

THOS. J. ROSSELL.

New Haven, Conn.

RESULT OF LOCOMOTIVE BOILER EXPLOSION.

Improvements in Japan.

Having from time to time seen articles in the RAILWAY AND LOCOMOTIVE ENGINEERING magazine concerning railroading in Japan, I decided that I would like to add my small contribution, and tell about a few changes that I have noticed on the railroads there.

After being absent from Japan for several years, I returned last year, and found to my pleasure that marked improvements had taken place in railroading. In the first place, before I left there were no American locomotives in existence on those islands (except on Yezo, where everything is on the American basis); but now on the main lines, although they may not be in the majority, yet the American locomotives are seen in great numbers, and every year they are becoming more and more numerous. The Japanese have weighed them in the balances of good hard labor, and they have not been found wanting. They are gradually putting their English cousins in the background. All the fastest and heaviest through trains are now pulled over the mountains and vales by the conquering American locomotive.

This fact alone proves that the Japanese consider the locomotive from across the Pacific to be the best. When the first American locomotives were put in operation there, the English residents were highly indignant at such an outrage, and they predicted that that trial would end in but better proving the superiority of the

English engines; but the outcome of the trial was the ordering of some more American locomotives from Schenectady. The Japanese, however, do not maintain that the American locomotive is perfection, or, on the other hand, that the English locomotive is without its merits. They claim that the English engine burns less coal and does not need to go to the repair shop so often as the American-made engine. This later fact is probably correct, for the English build their locomotives with the greatest care, and each part is made equally well, so that they last forty or even fifty years, while the Americans build theirs so that the locomotive of to-day may to advantage be discarded for something better in fifteen or twenty years hence. The Japanese are all agreed on this point, however, that the cab of the American locomotive is away ahead of the cab that is tacked on to English engine. A favorite designation of the English locomotive is an "engi" (Japanese word for locomotive; corrupted from engine) with standing room at one end!

Although the English call the American locomotive an absurd-appearing conglomeration of steel and iron, yet when it is placed alongside or coupled to an English locomotive an American cannot but help noting how much more symmetrical and graceful she appears as she towers above her rival from the opposite side of the world. To the American even the blast from her whistle or her puffing has a good wholesome sound.

Japan is quite cosmopolitan in respect to locomotives, the writer having ridden behind English, Japanese, German and American-made locomotives. But of all these the American stands out far beyond the others in its sterling qualities.

The rolling stock is as yet most of it English in style. But here again I was pleased to discover a change for the better. When I left Japan there were no such conveniences as sleepers or dining cars, and cars on eight wheels were as scarce as "flies in January." Now all the through trains have sleepers and diners lit up with electricity and heated with steam. One company just recently adopted the Pintsch lights. Vestibuled cars are now also seen. From what I have said it must not be inferred that the trains are as luxurious as the express train of Pullman sleepers are here in the United States, but compared to what they used to be in Japan the cars are vastly improved.

As to the speed of the trains, not very much can be said in praise, for their fastest mail and lightning express trains make on the average the extraordinary speed of thirty miles per hour! However, this speed generally accommodates all the passengers in Japan, for they compare the speed with what it used to be, when they traveled on foot or in jinrikisha (a small carriage hauled by one or more men) at the rate of five miles an hour. Even the foreigners are satisfied when they remember that, what took five days of the hardest kind of traveling on foot, or by pack-horses or in the jinrikisha, can now be accomplished while they take their ease in the sleeper between the setting of the sun and the next dawn.

Thirty years ago Japan had but two short lines of railroad (one of twenty miles, the other of eighteen), concerning which a rather imaginative student wrote in an essay that they spread over the Empire like a vast net work of steel; to-day she has three thousand miles. That amount may seem small to the American, but it must be remembered that the Japanese are Orientals just awakening from the darkness of superstition and heathenism of centuries duration, and that the Empire is no larger than Montana, and half of that is so mountainous as to be uninhabited. An expert has said that seven thousand miles is all the railway that can be utilized in Japan, so that the Japanese have reached nearly the half-way mark in respect to its mileage, which is more than the United States can say!

GEO. H. WINN.

B. & M. Resorts.

Have you chosen your vacation ground for the summer? If not, now is the time. The vacation resorts are now thronged with an army of summer tourists, and to the first arrivals come the choice. New England has a large list to choose from, and the best way is to secure a Boston & Maine Summer Excursion Book published by the General Passenger Department, Boston. A copy of this most interesting "directory" will be mailed upon receipt of address, and it will be sent promptly.

Manufacture of Rubber Hose.

BY CHARLES DUNN.

The process of manufacture of rubber hose to be used in connection with air brakes and steam heating differs in detail at the several makers' works. This article attempts only to describe one of the methods in vogue.

Air and steam hose consists primarily of an inner tube of rubber, several plys or layers of duck on the outside of this inner tube, and the outside covering of rubber.

The rubber is purchased by, and delivered to, the hose manufacturer in the crude state, just as it is cut from the tree. This crude rubber, when being worked up at the factory, is passed between corrugated rollers over which a constant stream of water flows. This method of manipulation takes out all of the dirt and bark and is continued until the rubber is thoroughly cleaned. The rubber is then suspended in a dry place to season, which seasoning should last for at least a month.

EXPLODED BOILER THROWN SEVENTY FEET AHEAD ON TRACK.

After this process, the rubber is passed between heated calenders and compounded with certain other materials, so that the proportion of pure rubber in the resulting compound varies from 40 to 60 per cent., depending upon the grade of base in which it is to be used. The calenders are large hollow rolls, heated by steam, which is admitted through one end of the shaft.

After compounding, the rubber is passed between the finishing rolls and brought to a thickness of about No. 24 gauge. It is then doubled and given a second and final pass, leaving the rolls at the required thickness which is about No. 18 gauge. The rubber as it passes through the finishing mill the last time, is rolled with a

layer of cloth between the folded layers of rubber. At this stage the rubber is of such consistency that it will stick together and form a coherent mass.

This sheet of rubber and cloth is now in condition to be taken to the cutting table and cut into pieces the proper length and width to make inner tubes for 50-ft. lengths of hose. The width varies in accordance with the diameter and thickness of the inner tubes, this width being made such that, when rolled the desired number of turns on the iron tube upon which the hose is built up, the thickness of the rubber will be as specified, usually about 3-32 of an inch. The length is slightly in excess of 50 ft., to allow for trimming at the ends.

The frictioned duck, as it is called, is next rolled on the inner tube, making 3, 4 or 5 complete turns, according as 3, 4 or 5 ply hose is desired. The frictioned duck is prepared by taking duck of the specified width and weight per yard (the width varying from 38 to 40 in., and the weight from 20 to 22 ounces, respectively, per yard), it is passed between heated calenders, upon one of which is a coating of rubber of the same quality as that used in making the inner tube. As the duck passes between the calenders a portion of the rubber is forced into the pores of one surface of the duck. The rubber on the calender is constantly renewed as used. Both sides of the duck are "frictioned," and for the best hose, where a layer of rubber is specified to be between the different plys, the "friction" coat on one side of the duck is made quite heavy and when the duck is rolled upon itself a distinct layer of rubber will be formed.

After the duck has been "frictioned," it is taken to the cutting table and cut on the diagonal, or as ladies would say, on the bias, the width on the diagonal being such that when wrapped around the inner tube it will give the desired number of plys. These pieces of duck, cut as described on the diagonal, are turned so that the original edges are brought together, lapping about 1 in., the "friction" on the duck being sufficient to fasten them together. This brings the warp of the duck on the diagonal when rolled in the hose.

When the "frictioned" duck is rolled in place on the inner tube, a layer of rubber is wrapped around it, forming the cover. The ends of the hose are then cut off even and caps put on. These caps are made of sheet rubber to suit to the size of the ends of hose. The label and table of dates is then put on the cover.

In placing the duck on the inner tube, cover on duck, label and table of dates on cover, and caps on ends of hose, the rubber in all of these parts is of such consistency that it will unite to form one whole, by the manipulation of hand or machine rolling, which these parts receive when being put together.

The hose is now completely formed and the next process is to wrap it tightly about with a strip of wet cloth. The strip is about 4 in. wide, and is fastened at one end of the hose and wound spirally to the other end, overlapping itself fully ⅝ of its width, thus making about 6 layers of cloth on the outside of hose.

The strips of wet cloth are rolled on wood rollers having handles projecting from both ends. In wrapping the hose with these strips it is revolved by machinery and the roller upon which the wet strips are placed is held by the operator, who can vary the tension on the strips by the friction of the roller handles in his hands.

The hose is now ready for the vulcanizing or curing process, which consists of placing it in a steam-tight cylinder about 52 ft. long. Steam is then turned into the cylinder until the desired temperature is reached, which varies from 240 to 280 degrees, all depending upon the grade of rubber in the hose. The time required to thoroughly cure hose also depends on the grade of rubber, the purer the rubber the higher the temperature required and the longer the time necessary to cure it.

After the hose is cured and removed from the cylinder, the cloth strips are taken off and the hose is removed from the iron tube, and if intended for air and signal hose, it is cut into 22-in. lengths, and if for steam hose, into 25-in. lengths. The freshly cut ends, which, of course, expose the duck, are then covered with rubber paste and a cap is stuck on. Iron bushings are pushed into the ends, pressing the caps firmly against the ends of hose. These lengths of hose are then placed in the vulcanizing cylinder again and left there until the caps are vulcanized.

When these short lengths of hose are taken from the vulcanizing cylinder and the iron bushings removed, the ends are somewhat rough and require dressing up on an emery wheel. The roughness is due to the fact that in order to insure having the ends thoroughly covered with rubber the caps are made somewhat larger than the ends of hose. The hose is then considered to be completed, and ready for inspection and use as required.

First Aid to the Injured.

A press dispatch from the West says: "Conductors, firemen, engineers and trainmen on the Chicago & Northwestern Railroad are to be made amateur surgeons. All train crews in the employ of the big system will be given instruction in the rudiments of surgery—the dispensing of first aid to the injured and the dressing of wounds received in wrecks and other accidents. By means of written instructions, special demonstrations, and a course of lectures by several of the company's district surgeons, all of the men on the road are to be made thoroughly acquainted with the proper thing to do first in each injury. These employees will be furnished with a kit of necessary materials for dressing wounds. On each train, freight as well as passenger, there is to be a stock of necessary instruments, bandages, antiseptic dressings, and medicines."

The practice of calling men instructed in first aid, "amateur surgeons," may be a harmlessly pleasant or humorous way of describing them, but it is far from accurate. They will not be surgeons in any sense of the word; they will be men who, possessed of ordinary common sense, will be enlightened by instruction and training, so as to do the right thing, or the simple, necessary thing, in case of emergency, to relieve suffering or to stop a bleeding wound until proper medical aid can be secured. It is often comparatively easy to do this when one knows how, but it may mean much to the sufferer.

Broken Whistle Valve Causes Excitement.

A broken whistle valve on the locomotive pulling a train into President Roosevelt's home, Oyster Bay, L. I., recently caused quite a stir among the summer visitors and residents of that hamlet. For twelve miles in approaching the town, and for fifteen minutes after arriving there, the broken valve emitted a shrill, continuous shriek. Some persons thought the unusual sound was an attempted ovation to the President. Municipal authorities hasted to the station and ordered the engineer to desist. Residents and visitors swarmed from houses and cottages and "rubbered," Girls and boys left the water in bathing suits, and joining men and women in duck suits and lawn dresses, hastened to receive the prominent visitor, whoever he might be, who was being heralded in noisy fashion to the peaceful town of Oyster Bay. One old salt declared that only the admiral of the navy was ever given such an ovation, and he rushed to the water front expecting to see that functionary approaching in state, supported by the whole White Squadron. He was disappointed, however, as were the other people. The unusual disturbance was explained and village equilibrium restored when steam was blown off the boiler and the broken valve repaired.

B. of L. E.

Toronto, Canada, was host to 350 delegates who were there in July attending the annual union meeting of the Brotherhood of Locomotive Engineers and the meeting of the Grand International Auxiliary to the Brotherhood. The delegates came from all parts of the United States and Canada. They were hospitably entertained while there and enjoyed the sights of the Queen city of Ontario.

New Iron Elevator.

A most remarkable grain elevator was recently put into service by the Iron Elevator & Transfer Co. of Buffalo, N. Y. This structure, which is shown in the accompanying illustration, is formed entirely of concrete and steel. It is situated on the line of the Lake Shore & Michigan Southern, and all grain passing east over that road is weighed and transferred from western into eastern cars at this elevator, which has an actual working capacity of 60 car loads of grain in and out, in a 10-hour day. In addition to the regular work of transferring grain in transit, the elevator is equipped for cleaning and separating mixed grains, and, for this purpose, has a storage capacity of 650,000 bushels. The storage space is divided into 90 separate steel bins with a capacity of from 1,000 to 12,000 bushels each. The bins are of rolled steel plates, cylindrical in shape; they are 65 ft. deep and the largest ones are 15 ft. in diameter. The foundation is of concrete and is built at a sufficient altitude above the ground to form a working story, or basement, 10 ft. high under the bins.

Grain is handled throughout the building by means of endless rubber belt conveyors, and elevating legs, which are driven entirely by induction motors located at various points in the structure. The aggregate power provided amounts to 280 h.p., which is divided among 5 Westinghouse, type "C" induction motors, varying in size from 30 h.p. to 75 h.p. each. The power is transmitted from the motors to the machinery by rope drives in every case. Electric power is received from the Niagara Falls power circuits in the form of 3-phase, alternating current at 2,200 volts. This voltage is transformed to 400 volts for distribution in the elevator. All motors are controlled from a fireproof electrical room in the basement of the elevator by means of a switchboard, from which the wires pass through iron conduits to the motors. In this manner all sparks attendant upon the starting and stopping of the motors are confined to this room and all possible danger of dust explosions and fires originating from the electrical apparatus is entirely avoided.

Compressed air is distributed to all parts of the elevator at a pressure of 100 pounds per square inch, and is used for blowing dust out of the motors, for sweeping floors and beams and for siphoning any water that may collect in the drain pits under the elevator. A blacksmith's forge is also supplied with air from this system.

In addition to the iron elevator just described, this company owns a wooden transfer elevator and a very large feed grinding establishment, the latter known as the Diamond Mills. The former is a railroad grain elevator of the old-fashioned wooden crib type, which has been operated with great economy heretofore by steam, owing to the fact that dust and grain clippings were burned as fuel. The Diamond Mills, also, received power from the steam plant of the wooden elevator. Both establishments will hereafter be operated by Westinghouse type "C" induction motors, receiving current from Niagara Falls. This change has been made as a result of the marked saving in cost of operation of the new iron elevator, as compared with even the undoubted economy obtained in the old house. The power equipment for these two plants is now being installed and will aggregate about 500 h.p.

All the electrical apparatus has been furnished by the Westinghouse Electric & Mfg. Co. The credit for the engineering and construction work is due to the Macdonald Engineering Company, of Chicago.

IRON ELEVATOR AT BUFFALO, N. Y.

Explosions of Dust.

In another column we give an account of a new elevator recently constructed by the Iron Elevator & Transfer Co. The starting and stopping mechanism for the electrical machinery of the plant is all contained in one fire-proof room, so that danger from fire or explosion of dust may not be caused by the sparking of controllers at the moment a contact is made or broken. An explosion of dust, as it is generally called, is not an explosion in the true sense of the word at all. It is really an extremely rapid burning of finely divided particles of solid matter which are floating in the air. Mills and elevators or places constantly filled with fine inflammable dust are liable to accidents of this kind.

What really happens when a so-called dust explosion takes place may be briefly explained as follows: Suppose a large log of wood to be left in the open air for an indefinite length of time; it will rot. Now rotting is just a very slow process of burning, and the log will perhaps be entirely consumed in 50 years. It will, during that time, give out a certain definite amount of heat. Suppose, however, the log had been split up into a number of large pieces, like railroad ties, and piled close together so that air could practically only get at the surface; if set on fire the ties would slowly burn, perhaps for a week. The quantity of heat liberated would be exactly the same as that evolved by the rotting log, though the time element is much shorter. If the log had been cut up into cordwood and the sticks sawed into stove lengths, and piled in a loose heap so that air could pass in between the sticks, the time required for complete combustion would be much shorter, probably a few hours, though the total heat given out remains the same as in the two former cases. If, however, the log had been split into kindling wood, it would have been burned in much less time. To push this method of reasoning a step further, one may conceive the whole log reduced to a huge pile of shavings, thrown together so that air would readily intermingle; the whole

flimsy mass might be burned up in a few minutes, and the liberation of heat, always the same definite amount, would take place, of course, very rapidly. If the log could be ground up into exceedingly minute particles of wood, fine enough to float in the atmosphere, each particle fully surrounded by air, yet each close enough to be at once affected by the combustion of its neighbor, it is not hard to see how a spark setting fire to a few particles of this inflammable dust might cause the combustion of the whole desiccated log in a second. It would be like a flash of fire with an almost instantaneous production of the total heat, which had hitherto been spread over easily appreciable periods of time. Such a sudden flash and such sudden production of heated gas would certainly display some of the characteristics of a violent explosion.

The Sun's Heat.

Sir Robert Ball, professor of astronomy and geometry in the University of Cambridge, England, in a book recently published, called "The Earth's Beginning," tells us of the sun's heat. He says: "Suppose that we extracted from this earth every ton of coal which it possesses in every isle and every continent; suppose that this mighty store of fuel, sufficient to supply all the wants of the earth for centuries, were to be accumulated, and that by some mighty effort that mass were to be hurled into the sun to be burnt to ashes; there can be no doubt that a stupendous quantity of heat would be produced. But what is that heat in comparison with the daily expenditure of the sun's heat? How long, think you, would the combustion of so vast a mass of fuel provide for the sun's expenditure? We are giving deliberate expression to a scientific fact when we say that a conflagration which destroyed every particle of coal contained in this earth, would not generate as much heat as the sun lavishes in the tenth part of every single second. During the few minutes that you have been reading these words, a quantity of heat has gone forever from the sun, which is 5,000 times as great as all the heat that ever has been or ever will be, produced by the combustion of the coal that this earth has furnished."

Peculiarities of Ice.

Melting ice has a temperature of 32° F. and there is a popular impression that ice is always at that temperature because it is frozen water and cannot change its condition except by melting. This is one of the popular mistakes about common things.

If a thermometer is buried in ice in summer it will indicate 32 degrees: If you throw a piece of ice into boiling water, and leave it there until it is almost gone, what is left will be still at 32 degrees. Ice can never be raised above the temperature.

But while ice can never be warmed above 32 degrees, it will go as much below that as the weather does. An iceman delivering ice one zero day in January was asked whether his ice was any colder than in July. He thought not. But, as a matter of fact, a piece of summer ice, if he had had it, would have been something of a foot warmer for him, as it would have been 30 degrees warmer than the air of the bottom of his wagon.

Mixing salt with ice makes it much cooler. The ice in a wine cooler goes down to about zero. This is why the point zero on our common thermometers was fixed where it is. It was supposed to be the lowest point which could be reached by artificial means. Since then we have reached about 383 degrees below zero by chemical processes.

Ice will cool down with everything else on a cold night to zero or below. What should prevent it? On a day when it is just freezing a block of iron, a block of ice outdoors will stay at 32 degrees. If the weather grows warmer the iron will warm up with the weather, but the ice will stay at 32 degrees and melt away. But if the weather grows colder the iron and the ice will cool off, and one just as much as the other.

As the ice grows colder it gets harder and more brittle. There can be no hickory bend on a skating pond on a zero day, for ice is then too brittle. Slivers of ice dipped in liquid air become so hard that they will cut glass. Water thrown on ice in the Arctic regions will shiver it like pouring boiling water upon cold glass. This is because the ice is so much colder than the water.

Model of An Old Locomotive.

Through the courtesy of Mr. R. P. C. Sanderson, superintendent of motive power, acting with the approval of Mr. J. M. Barr, vice-president of the Seaboard Air Line Railway, Purdue University is in receipt of a full-sized model, accurate in all of its details, of an early locomotive. Mr. Sanderson states that the model represents the locomotive "Tornado," which was the second owned by the parent roads now forming the Seaboard Air Line Railway. It was purchased in England and placed in service in March, 1840. It has a single pair of drivers, a four-wheel truck, and a cylindrical firebox. A tender carried on four wheels is attached.

A Railway in Mid Air.

A railway, if so it can be called, reaching 2,000 ft. in the air, with steel ropes for tracks and iron buckets for cars, is the regular means of transportation over Deep Gulch in the Rocky Mountains of Colorado. The system was built by Leschen & Sons Co., of St. Louis. The line is 4,200 ft. long, extending from the works of the American Gold Mining Co., situated in the valley, to the mine which is perched like an eagle's nest some 2,000 ft. up amid the crags of the mountain.

There are two sustaining cables securely anchored at each end. Loaded buckets run on a rope 1⅛ in. in dia., while empties return on a 1-in. rope. The buckets are propelled by an endless steel wire rope ¾ in. in dia. Each of the buckets has a capacity of 6½ cu. ft. and is so placed as to swing freely. The difference in elevation between the two terminals is, as already stated, about 2,000 ft., and the weight of the loaded buckets going down is sufficient to bring supplies up to the mine.

Railway Accidents in Great Britain.

The British Board of Trade returns have been issued, and they show that the working of trains did not cause the death of a single passenger during the whole year, though 1,142,277,000 passengers were carried, and 402,065,000 train miles were run. There were 476 passengers injured. The accidents to employees being 511 killed and 4,243 injured for 1901. Of these 8 were killed and 156 injured (as against 24 and 180 in 1900) by the working of trains.

In this connection it is interesting to remember that the railway mileage of Great Britain is, roughly speaking, about one-ninth that of the United States, but the passenger traffic is much more dense in the British Isles than it is here.

Dealing with the failure of tires, axles and rails, the report says: Of the 199 tires which failed there were 9 engine, 2 tender, 4 coach, 23 van, and 161 wagon tires; of the wagon tires no less than 125 belong to private owners; 120 tires were iron and 79 steel; 177 by failure of bolts, rivets, or screws; 18 tires broke at bolt or screw holes, 64 in the solid, and 117 split longitudinally or bulged.

Of the 175 axles which failed, 116 were engine axles, viz., 95 crank or driving, and 21 leading or trailing; 10 were tender axles; 1 was a coach axle; and 48 were wagon axles; of the wagons, 24 belonged to private owners.

Of the 324 rails which broke, 77 were double-headed, 209 were single-headed, 1 was a bridge rail, and 37 were Vignoles' rails; of the double-headed rails, 35 had been turned; 1 rail was iron, and 323 steel.

Both Sides to Meet.

We are informed that it is intended to hold a national conference of employers and employees in Minneapolis September 22 to 26 inclusive. This will be an attempt to inaugurate a campaign of education on the labor problem, with a view of promoting a better feeling be-

tween employers and employees and furthering the work of social and industrial betterment. This national gathering is designed to afford an opportunity for the free exchange of ideas on the present labor problem. The promoters of this movement have no cure-all to advocate and no propaganda to spread. Their one aim is to afford an opportunity for the two opposing sides in the present labor disputes to get together on neutral ground and calmly talk over the situation. Mr. G. L. Rockwell is secretary, with headquarters at Minneapolis.

Narrow Gauge Engine for the Mexican Southern.

The Cooke Works, the Paterson, N. J., plant of the American Locomotive Co., has recently turned out some narrow gauge engines for the Mexicano del Sur. These engines are of the ten-wheel type, and have some peculiarities of construction, one of them being the outside frame, and the crank on the end of the axle, which somewhat resembles the English method. They are heavy engines for narrow gauge service, weighing 187,000 lbs. in working order, and running upon a track of three feet gauge. The cylinders are 17 x 20 ins., and the driving wheels are 47 ins. in dia., outside tires. The boiler is of the straight top type, radial stayed, and is 52⅛ ins. in dia. at the first course. The tender carries five tons of coal and 3,000 gallons of water.

A few of the principal dimensions are given below:

Cylinder—17-in. bore, 20-in. stroke.
Weight on drivers—58,000 lbs.
Weight on trucks—29,000 lbs.
Total weight in working order—87,000 lbs.
Loaded weight of tender—67,000 lbs.
Driving wheel base—13 ft. 2 ins.
Total wheel base of engine—22 ft. 1 in.
Wheel base of engine and tender—42 ft 7 ins.
Driving wheels—Dia. 3 ft. 11 ins.
Driving wheel centers—Cast steel.
Engine truck wheels—Dia., 30 ins.; cast steel center with 2-in. tires.
Driving axle journals—7 x 7 ins.
Engine truck axle journals—4¾ x 7 ins.
Boiler—Straight top, radial stayed.
Working pressure—160 lbs.
Boiler dia., first course—52⅛ ins.; thickness of shell, $\frac{9}{16}$ in.
Fire box, length—49$\frac{3}{16}$ ins.; width, 44⅞ ins.; rocking grate.
Boiler tubes—134; dia. 2¼ ins.; length, 11 ft. 7 ins.
Heating surface tubes—997 sq. ft.; fire box, 77 sq. ft.; total, 1,054 sq. ft.; grate surface, 1,538 sq. ft.
Slide valve—Richardson balanced; travel, 5½ ins.
Steam ports—Width, 1¼ ins; length, 14 ins.; exhaust ports, 2½ x 14 ins.
Lap of valve—¾ in. outside; line and line inside.
Smoke box—Extended; netting, 5 mesh 15 W. G. placed in stack.
Center of boiler from rail—6 ft. 1½ ins.; top of stack from rail, 13 ft. 9 ins.
Tender—Frame, 8 ins., steel channel.
Truck—Arch bar, combination bolster.
Truck axle journal—3¾ x 7 ins.
Truck wheels—Cast steel center, with 2-in. tires; dia., 30 ins.
Tank—Water capacity, 3,000 gallons; coal capacity, 5 tons.

NARROW GAUGE TEN-WHEEL ENGINE FOR MEXICAN SOUTHERN.

Boilers for Locomotives.

The Engineer (London) in speaking editorially in a recent issue of "boilers for locomotives," says, among other things, "There does not appear to us to be any reason, up to a certain point, why a very successful locomotive should not be made with a water-tube boiler, say of the Yarrow type, which, having straight tubes, seems to lend itself better than any of the bent-tube types to this particular purpose. An extremely powerful engine of moderate weight might be made by mounting a water-tube boiler midway between two four-wheeled bogies, each provided with a pair of cylinders compounded. Any desired grate surface could be had. The objection is that the engine would be too long to fit existing turntables, and we recognize the importance of the objection. Yet such an engine need not be turned at all. For coal could be carried at one end and water on the other, and no tender would be needed. But if the Yarrow type does not answer there are several others available."

This reminds us somewhat of the prediction regarding the locomotives of the future made by Mr. S. M. Vauclain, of the Baldwin Locomotive Works. It is interesting to know that some eminent authorities regard the water-tube locomotive boiler as a possibility. It would be still more interesting if some one would come forward with a definite design for such a machine.

English Concern Bought Up.

The head of the International Pneumatic Tool Company, of London, England, was in the United States arranging the final details of the transfer of that company to the Chicago Pneumatic Tool Company. The latter will consolidate the factory of the International Pneumatic Tool Company with their plant in London. The Chicago Pneumatic Tool Company have been compelled to operate two of their plants in America extra time, and this addition to their London plant will give them a much needed increase in manufacturing facilities. At the present time the Chicago company have a force of experts in Glasgow, giving an exhibition of ship riveting and ship construction with pneumatic tools under the auspices of the Glasgow Federation of Ship Builders, and it is anticipated that all of the yards on the Clyde will very shortly be equipped with pneumatic tools.

If you entertain the supposition that any real success, in great things or in small, ever was or could be wrested from Fortune by fits and starts, leave that wrong idea here.—*Bleak House.*

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To Make the Metric System Compulsory.

Some of our lawmakers are intensely anxious to force the French system of weight and measures upon the people, and they imagine, because there is no active opposition manifested, that the people are indifferent and will accept the change to the metric system without a murmur. The people in the United States are so much accustomed to the idle vaporing of legislators that they do not trouble themselves to make protests against proposed laws, however vicious or idiotic they may appear; but when attempts are made to enforce laws that entail extra expense and daily inconvenience, the voice of the people is heard in a fashion that strikes terror to the hearts of the worst cranks in Congress. We suspect that Congress will insist on making the use of the metric system compulsory, and that the members will not estimate the magnitude of the opposition until enforcement is attempted and pains and penalties are inflicted for violation of the law.

Those familiar with the metric system think that machine shop owners and manufacturers of machinery will be put to the greatest inconvenience and expense by a change of measurement, and few advocates of the change have a realizing sense of the magnitude of the changes that would be involved. The size of all screw threads are established in fractions of the inch. As changing the size of screw threads to coincide with metric units is out of the question, the denominations of the existing standards would have to be made in millimeters. There are 25.38 millimeters in an inch, which is too small for a convenient unit, a highly important detail when rapid and accurate production of finished machine work is considered. The owners of manufacturing establishments would have to scrap all their gauges, templates, jigs and measuring apparatus. Railroad companies would have to change all their standards to make them accord with metric units and their men would have to acquire knowledge of new dimensions in a strange language that would cause great confusion.

The weights would all have to be changed from the pound universally used in English-speaking countries to the gramme, 15.4323 grams, or to the kilogram, 2.2046 pounds. The housekeeper might soon fall into the habit of calling for half a kilogram instead of a pound of tea, but the change would require the altering of a multitude of weighing scales that would be an intolerable tax upon the community.

The litre, which is the unit of the measure of capacity, would not perhaps give so much inconvenience as the other as it is 1.760773 pints, or practically one pint and three-quarters. But the adoption of the metric measure would involve the changing of all capacity measures, a most stupendous undertaking.

Intelligent people in the habit of making quick calculations would soon become accustomed to the new metrology, but the great mass of the people are not intelligent, and those who are ignorant would be a prey to rogues who were ready to cheat them by the confusion of the new weights and measures. These victims are the people who would make their complaints aloud, and their grievances over the change would make excellent capital for political demagogues to agitate upon. An attempt may be made to enforce the introduction of the metric system, but it will bring misfortune to the political party supporting it. Its introduction into France nearly caused a revolution at a time when that country had no industries of any consequence to be disturbed by the change. We can imagine the furore it would make in the English-speaking countries, where three-quarters of the manufacturing industries in the globe are carried on.

Steel in Car Framing.

It is difficult to reconcile the actual practice in car construction with well-known requirements, when it is seen that so few builders embody in their cars the recommendations often readily made in discussing the needs of the service. There are all kinds of propositions made on the sill question with reference to the use of steel, and among these we find a remarkable unanimity as to the need of steel in sills, but there appears to be no well settled policy as to the treatment of all sills—some seeming to favor center sills of steel in combination with other sills of wood

In view of the well-known weakness of a composite construction, it is strange that such a proposition should find any adherents, with our present knowledge of the art. There is enough data in existence at this time to show the fallacy of any attempt to harness steel and wood together in a place requiring rigidity. The lesson very plainly taught is that composite construction has no place in car framing any more than in body or truck bolsters, but there are men who have the temerity to put up bolsters on the sandwich plan to-day, even in the light of repeated failures.

The fact that the center sills are directly in line with impact stresses has influenced, to a large extent, the advocacy of steel for center sills alone, losing sight of the equally important fact that the remaining members of the under frame are called upon to absorb a certain proportion of the buffing shocks. Since there is no question as to the relative value of wood and steel to withstand impact, there should be no doubt about a choice of material for sills.

A good reason having been found for the use of steel, in its superior transverse strength, it would seem that a like reason could be adduced for buffing strength also, but there appears to be a failure to grasp the idea of the column, when weighing the functions of car sills. The paramount need in the underframe is rigidity, and this is to be obtained only with steel sills, an absolute divorce from wood being the rational solution of the problem.

There is an important advantage gained in making steel center sills deep enough to withstand excessive deflection, aside from the advantage of taking better care of impact stresses, and that is the increased life of draw-gear attachments, by reason of the stresses more nearly approaching the line of the neutral axis of the sills—the ideal condition, of course, being when the center line of pull is coincident with the horizontal center line of sills. Under the latter condition the destructive action of shocks due to buffing is at the minimum. The magnitude of such shocks is terrific when acting through a lever arm of 8 or 10 inches, as they do in the ordinary draw timbers as bolted to the underside of sills.

With the center lines of draw gear and center sills in coincidence, all bending moments disappear, and the stresses are

simply those of tension and compression. This feature of draft-gear design is one that cannot be ignored in the heavy equipment now going into service, and it presses also for recognition in the wooden underframing to an extent that should be heeded, if repair bills are to be reduced.

What has been said with reference to composite underframes applies with equal force to the superstructure of a freight car, but a slightly different line of reasoning may be found to apply, since it has not yet been determined that it is necessary to use steel with the idea of utilizing such material as a truss to assist the underframe. While it is true that such use of the upper frame may be regarded as the proper one by the designer who has absorbed bridge construction ideas, the fact is a patent one, that if the superstructure is designed to perform truss functions, and thus carry a part of the paying load, it will likely be found to carry with this advantage a high percentage of dead weight in the majority of types of freight cars, although we are fully alive to the fact that such design has been well worked out in some few instances. It is very doubtful if success would attend the attempt in the case of box cars. When, however, the superstructure is built of steel with the single purpose of protection to the load, as has been the aim in design of most of our wooden equipment, there is no doubt that a lighter and stronger design is possible with steel than with any other material, and this is of special significance now that the American Railway Association has fixed upon dimensions for a standard box car, these dimensions agreeing practically with what many roads had adopted as standard for an 80,000 pound car, and we therefore now have the opportunity to design standard dimensions for the details of one type of car at least. It is hoped that there may be some action taken at an early date by the Master Car Builders' Association, with steel as the basis for such design. There are no insurmountable difficulties in the way of adoption of standard dimensions for the parts of any car, if the question is approached in a spirit eager to reach results, and we have every confidence that the deliberations of the above named body would crystallize quickly into figures that would be a lasting improvement on present methods, if the M. C. B. Association would take the initiative, as they no doubt will.

Some Observations on Accident Bulletin No. 3.

The Interstate Commerce Commission has published Accident Bulletin No. 3, covering the first quarter of this year. In comparing the tabulated analysis of accidents here presented with the figures given in Bulletin No. 2, which dealt with the last three months of 1901, we see that fewer people have been killed and injured, fewer accidents have taken place and the money value of the property destroyed has been less. Nevertheless the figures are large; 813 people, passengers, employees and others, were killed in the last months of 1901, as against 665 in first quarter of 1902. There were 10,235 injured in the same period last year as compared with 9,558 in the opening months of this year. The closing quarter of 1901, cost $2,075,091, while the accidents in January, February and March, 1902, destroyed $1,914,258 worth of property. These figures are interesting, no doubt, and show some improvement, but if the loss of life and injury to human beings progresses at even the lower rate with which this year has opened, there will have been 2,660 persons killed, and upward of 40,000 injured, by the end of December.

Table No. 3, giving causes of accidents to employees in coupling and uncoupling cars, shows, when placed side by side with the similar table in the preceding bulletin, that the "not clearly explained" cause, has been most satisfactorily reduced. In Bulletin No. 2, under this head, there were 11 employees killed and 147 injured, while in the bulletin before us this scanty information item, shows only 2 killed and 51 injured. This does not mean that the grand totals differ in anything like this proportion; as a matter of fact the difference is only 3 less killed and 24 less injured in the first quarter of 1902. The decrease referred to, means that more accurate information has been given regarding coupling accidents, which is very important. Notwithstanding this improvement, the "miscellaneous," and the "not clearly explained" causes very much outweigh all the 19 other causes which appear in the table. The significance of accurate information, and the relative importance of things, may be seen by a glance at two items given in this table. There were 6 employees injured and 1 killed due to parts of couplers sticking, while there were 12 injured and 4 killed in coupling, by reason of overhanging loads on platform cars. This turns the searchlight on dangerous loads on flat cars. In table No. 2, giving the total number of the various kinds of accidents and the amounts of loss due to each, we find, under the head of derailments due to defective roadway, etc., that there were 143 accidents. The derailments due to defective equipment brought about 369 accidents. This latter is at the rate of 123 a month, or more than 4 a day. We think if it were possible for the commission to split up both of these items, the figures then given would be much more valuable. For instance, if defective equipment was resolved into derailments due to failure of wheels, failure of axles, failure of trucks, brake parts falling upon track, and other causes, it would give to the students of such matters an idea of the relative importance of the parts which failed. If, for example, it were shown that wheel failures accounted for the bulk of the defective equipment accidents, a united effort on the part of manufacturers and users of wheels all over the country to apply a remedy, would result at once, almost as a matter of course. Defective roadbed might, perhaps, be made to include rails breaking, track spreading, failures of bridges or culverts, accidents at switch points and frogs, and other causes.

Accident statistics are valuable, not only as revealing progress toward safer operation or the reverse, but they are of enhanced value in proportion as they show up the weak spots. The Interstate Commerce Commission is to be congratulated upon the undoubted care and accuracy with which their work has been done, and it is in no spirit of idle or carping criticism that we have ventured to suggest the securing of still further detail, the collection and tabulation of which, though exceedingly valuable, would be by no means an easy matter.

The Evolution of Per Diem.

The per diem system of paying for cars by the day, as the name implies; went into effect July 1 last, but although the date marked a definite period, there had been work done for a long time previously, which led up to, and made the realization of per diem, possible. In fact, per diem is in a certain sense, the result of evolution.

In former times when the responsibilities of car owners were not as clearly defined as they are now, per diem would have been very difficult of operation, not to say impossible. In the days when the center-plate-and-bolt fad tied up hundreds of cars in repair tracks, or when the wrong-draw-bar idea held a prominent place in car interchange, the payment of rental by the day would have added to the burdens which the railways were then carrying without much benefit resulting. The car owner has been compelled year by year, as the M. C. B. code was periodically revised, to gradually assume more and more, until now he practically bears the entire maintenance charge of his own cars. He makes good that which fails under fair treatment; the user paying for what is damaged or broken through rough handling or carelessness. Inspection for safety only, as it has been called, did not, like Jonah's gourd, come up in a single night; the inspection we have to-day was the result of a process of education, in which the art of "cut and try" had a place. With the simplifying of car interchange, per diem came naturally in sight. At the present time, the operation of the principle of

owners' responsibility, and the per diem rental arrangement, have reduced the whole thing to as businesslike a basis as that upon which a good livery stable is run. You take out a vehicle at so much an hour; if the carriage breaks down without ill-usage on your part, the liveryman has to stand the loss; if you smash the vehicle by careless or reckless driving, you pay for what you break in addition to the hourly rental. The principle involved, works out with perfect justice in everyday life.

Per diem is thus seen to be not so much a sudden change from established customs as it is a step in the orderly advance which the spirit of progress toward simpler and fairer business methods has produced. The ground having been cleared, it comes, almost as a matter of course.

In time other steps will be taken forward. Perhaps the question of "consequential damage" will some day come in for revised treatment. As it stands now, it is somewhat out of touch with the spirit of present practice. The history of the past has been the record of gradual and healthy growth in sentiment and method. Readjustments are sure to come, and many questions which now look as if fully settled, may find new, adequate and thoroughly equitable solutions in the future.

Piston Valve vs. Slide Valve.

After a careful survey of the locomotive valve situation, there appears to be as little definite or reliable information showing the value of the piston type of valve, now, as a settled unit among locomotive details, as at any time in its history.

One of the claims made for the piston valve is that of absolute balance, and such claim is pressed as a prominent feature in its superiority over the old slide valve. The word balance is here understood to mean an equality of forces on a valve, that is, the pressures are of the same intensity in all directions. It is true without doubt that this condition obtains with the piston valve, but it can hardly be claimed that the valve is balanced in the sense we understand it when applied to the balanced slide valve. In the latter case we are able to reduce pressure on top of the valve to any desired extent, and thus diminish resistance to motion. A valve so treated may properly be said to be balanced, since the pressures above and below are nearly in equilibrium, and such a valve will move with very little resistence. In the case of the piston valve, however, we may have this condition of balance as far as the equality of forces is concerned, but the valve has not been relieved of friction, especially if there is any ring surface exposed to the action of the steam by which the rings are forced against the steam chest walls. It will be seen that there is something of a difference in the meaning of the word balance when used in connection with the two types of valves. In the one case we have a partial balance with low resistence, and in the other, a "balance" with high internal friction.

The evils attending a high valve resistance unfortunately do not remain where they originate. Their influence is felt from the valve back to the eccentrics, and all parts must be made heavier and stronger to overcome them, more especially the rockers where the forces are made to change their direction. The result in all such cases is a springing of the eccentric rods and valve rods to such an extent as to very often give an uneven valve action.

There is no doubt that failure to properly lubricate a valve would aggravate the case, but the fact remains that there is too much internal friction on the piston valve with rings as generally constructed. A prominent eastern road has recently gone to the expense of scrapping a pair of new piston valve cylinders in order to apply balanced slide valves, simply because the engines could not deliver to the draw bar the power developed in the cylinders. This engine now shows the effect of the change in valves by an increased hauling capacity.

At the last Master Mechanics' convention there was a discussion of this subject, during which mention was made of the use of the ordinary plug piston valve fitted up to replace the slide valve. It was stated that after six months' trial no perceptible wear was found. It was, however, decided that there was little advantage in its use. It is possible that the plug valve may be made to overcome the objection as to friction, and it may also be made to prevent the loss now experienced by leaking packing rings—a loss representing a considerable waste of steam and one not realized, except as measured at the coal pile. It would be interesting to know whether the plug valve can be made tight enough to be steam tight, and yet free enough so as not to seize when contraction of chest takes place when running shut-off. If this plug valve is a mechanical possibility, then one of the most serious objections to the piston valve vanishes.

Among the advantages cited by friends of the piston valve is the liberal port area gained by that design. It is to be observed, however, that little is said about the enormous clearance which usually goes with that design, amounting in some cases to as much as 15 per cent. of the cylinder volume. There is no excuse for such an extensive use of steam space, since clearance can be cut down to equal the best showing of slide valve cylinders in that regard. A well maintained steam admission line on an indicator card is an exhibition to bring joy to the heart of the steam expert, but it is well known that those who give the best thought to ways and means for producing horse power on the least expenditure of fuel, are disposed to look upon such excellence as dearly bought when obtained at the price of such clearance as is common on most of the piston valve locomotive cylinders.

One of the important counts urged against the piston valve, is the want of flexibility of the valve when subject to accumulated water pressure in the cylinder. This rigidity is provided against by the use of relief valves and by-pass valves, all of which introduce new complications, and this fact is made the most of by those who see no good in the piston valve. In the attempt to furnish an avenue of escape for these pent-up forces the use of a sectional packing has been proposed, made something like the old-time Dunbar. This looks as if it might be within the range of possibility, if designed so that the rings could be kept out of the bushing ports. Something of the sectional type has been devised, we believe, and has been put in service abroad. We have, however, no data that will be of service in application to our conditions. It is open to question whether such a solution would give the required relief as quickly and with the same certainty of freedom as that which obtains with the balanced slide valve, which from its construction permits a lift from the seat of such amplitude as to relieve the cylinder at a critical moment.

It is not our contention that a piston valve cannot be made to give satisfactory results; we simply aim to make clear the fact that there is a large number of mechanical men who agree with our sentiments, and who believe that the piston valve is a device capable of much improvement before it should be accepted as the proper thing for steam distribution. Among the legion of these valves coming under our observation, there is but one, in our opinion, which may fairly claim the attention of locomotive men. Nearly all of the objections noted here are absent in this particular valve, which, by the way, is not in universal use for the reason that the inventor of it thinks he should have royalty as a condition precedent to its use, seemingly oblivious to the fact that the merits of a mechanical device are best recognized when not under the protection of the patent office.

Where a Locomotive Gets Its Energy.

Coal is the result of natural processes which have gone on in the world thousands of years ago. The vegetation of a bygone age, in the process of growing, did what the trees and plants about us to-day are doing. In the presence of sunlight, through their leaves, they abstract from the atmosphere, which always contains a certain amount of carbonic acid, the carbon which they need,

and set free the oxygen contained in this compound. They absorb water through their roots and so get the oxygen and hydrogen which they require for the formation of tissue. Now the carbon, oxygen and hydrogen are in far different proportions, in this tissue or cellulose, than they are when combined as water and as carbonic acid. The plant then, takes inorganic compounds and separating their constituents, builds its own organic structure on its own plan. The point to be noted particularly is that the plant has broken up existing chemical compounds for its own purposes; and to separate a chemically combined substance, requires the expenditure of energy. This work can only be done in the presence of sunlight, and so all plants, in growing, store up energy received from the sun. The carbon now in the plant is ready to fly back to the oxygen of the air and form carbonic acid, if only the appropriate conditions can be secured.

This ancient flora buried in the earth, compressed and hidden away under tons and tons of mineral matter, unable to rot, which is but to slowly burn, has all the time retained the power to reunite its carbon with the oxygen from which it had been torn. This coal has in it, stored up, energy which may be called the *potential energy of chemical separation.*

Coal heaped upon the tender is ready to give back in the kinetic or active form the energy it once received from the sun. It is like a stretched bow, ready at the moment of release to shoot its arrow toward the mark. The necessary temperature condition is found in the firebox, and a rapid and powerful reunion with the oxygen of the air takes place. This combining again of previously separated elements gives out heat most rapidly. The burning coal gives back faithfully, in quantity, all the energy received from the sun which had been stored up in it in the days when the earth was young. The amount of energy given out as heat by the burning coal in minutes may have taken the ancient plants years to accumulate.

It may be that the tropical heat and light of the sun poured lavishly upon the luxurious, spreading, growing vegetation of the early days, when plant life flourished vigorously on the earth—the energy stored up day after day in unbroken sequence for long periods, by all the various forms of plant life —may now be liberated and changed from the potential state and rendered intensively active in the few short hours in which a train rushes from New York to Albany, or flies from Philadelphia to Pittsburgh.

The liberated heat from the burning coal strikes the sheets and interior of the flues and passes into iron and steel. The molecular motion which we call heat, communicates a like motion to the particles of the steel plates and the iron tubes; with slight loss in passing through these, it leaps out into the film of water lying around the flues and against the plates on all sides. Here the heat motion is transferred to the particles of the water, these expand, rush off toward the surface, rolling and tumbling and foaming with steam.

This heat, which is still energy derived from the sun, has to do a large amount of work in dealing with water. If the engine is carrying a pressure of 200 lbs., the water must be heated to a temperature far above 212 degrees F. Energy is expended in doing internal work in changing water from that state into steam. In this case the water has to be heated up to a temperature of about 392 degrees F.

The energy which has been communicated to the steam is believed to have a somewhat different form of molecular activity to that of a liquid or a solid. In the case of a heated solid the molecules vibrate without passing over each other or changing their relative positions. In liquids they can move about in all directions and seethe and boil. In a gas they tend to fly completely away from one another. If the gas be confined, such as the steam here considered, pressure is maintained by a ceaseless bombardment of the walls of the containing vessel by the particles within, trying to fly off.

When the throttle is opened, steam rushes through the dry pipe to the steam chest and cylinder with some loss of heat, taken to warm the walls of chest and cylinder. When the bombarding of the piston takes place by the myriads of particles of the steam, the piston is not able to resist the continuous blows of the tiny molecules of steam at high pressure. It therefore gives way and moves in the cylinder. It is here that molecular motion becomes molar motion, and the engine moves.

We have traced in brief, the cycle of the energy radiated by the sun as heat and light. It was stored up through the separation of carbon from oxygen thousands of years ago by the plants of that remote era. It has been kept for us all these years potentially in the coal. It has given out its energy as heat and light again by the recombining of carbon and oxygen in the firebox; it has passed as molecular motion through steel plates, changed the physical state of water from liquid to gas, it has, as molecular motion again, caused to move the pistons of a locomotive, and so to turn its wheels.

We now use the stored-up energy of a long, and long-gone-by age to minister to our wants to-day. We dissipate in an hour the accumulated energy of years, and the power which draws grain from the wheat fields of the west, or lays the metropolitan newspapers on the breakfast table of a country hotel, was contracted for by our earth and its plant life, and delivered by the sun, ages before the very beginnings of our race had found any place in the scheme of created things.

European Railway Notes.

BY ANGUS SINCLAIR.

Fast Trains.

There is no subject connected with transportation which excites at once the interest of the public and of railroad men to the same extent as high-train speeds. I have seldom met people connected with any railway of the least importance who were not prepared to claim that some train on their line had made speed at one time or another which had broken all records. This sentiment is not confined to any particular country. It prevails wherever locomotives are found pulling trains. From what I have lately seen and heard, some French railways are claiming to lead the world at present in respect to high-train speed, but there is very little difference between the speed of their fastest trains and that of the fastest trains in Great Britain and America. The Empire State Express continues to deserve the credit of being the most extraordinary fast train run in the world, although one or two French trains make a higher average between terminals. This is helped by shorter runs between terminals and by lighter trains. British railway companies demonstrated years ago that they could maintain speeds of 60 miles an hour over runs exceeding 500 miles with very light trains which scarcely reached the paying load. Since that time they have all been contented to drop down to a comfortable 50 miles an hour or less. That is about the highest average speed a traveler may expect to find in the British Isles, but he will be accommodated with trains making that speed very frequently. On most of the railways connecting London with Scotland one may get a fast express train almost every hour.

Nearly all the trains are very light, seldom exceeding 150 tons behind the tender. But one marvels at the small engines that pull them. There are, of course, heavy engines pulling the principal heavy express trains; but the ordinary engine is four-coupled with cylinders about 18 x 26, driving wheels about six feet and a half diameter, and a 56-inch boiler providing about 1,300 square feet of heating surface. Most of these engines steam admirably, but they ascend the grades very laboriously and make up the average speed by rushing at high velocity down the hills. There appears to be more care taken to keep the lines clear for express trains here than there is with us, for a through train is seldom checked by an adverse signal, but the freight trains, which on our lines ob-

struct the passenger traffic so often, are here very light and short and keep dodging from siding to siding, their principal mission apparently being to avoid passenger trains.

THE AMERICAN ENGINES.

I have been trying to find the cause of the prejudice against American-built locomotives in Europe and have learned some things that may interest our readers, but I will have to delay the recital at present. The tendency of locomotive designing in Europe may also as well wait for description in my next letter.

ABOUT DINING CAR ETIQUETTE.

It used to be that the rivalry between British railway companies was directed principally to passenger train service and the desire to excel each other in speed and comfort brought about the rapid introduction of the corridor train with heavy, steady-running cars and the privilege of enjoying meals on the train. This was a very desirable change from the small four-wheeled compartment car which formerly was used exclusively on through trains, even for the longest distances. Now dining cars and lavatory conveniences are found on all the important through trains. They have what we would call peculiar fashions here with dining cars. The passengers sit in the dining cars throughout the whole of the journey. Only passengers first-class can go into the first-class dining cars, and once they have taken possession of their seats the passengers in other first-class cars must remain hungry unless some of the people in the second-class dining car will move to the smoking part. This was my experience on the London & Northwestern. This is a case where the railway companies might well take a lesson from the American book of experience and let people take their turn in the dining car. So long as a person pays for the meal, the railway company ought to be satisfied no matter what class he or she belonged to. But class distinctions are here very rigidly drawn.

In a run made on the Midland Railway since the above was written, I found that the dining car was used much in the same way as such cars are used in the United States. Every person who desired a meal found the necessary accommodation.

MOVEMENT OF FREIGHT.

The rivalry nowadays between British railway companies is beginning to be directed to the economical movement of freight. Until very recently railway managers on this side have paid no attention to moving freight at low cost. At the beginning of the railway era the coal truck, an open four-wheeled car of about four tons capacity, similar to the vanished "jimmies" of our coal roads, was adopted as a freight car and with very little enlargement is the "goods wagon" of to-day. In the ordinary way of loading, the dead weight is about twice the paying load. You see locomotives all over the country dancing about with from ten to twenty of these cars and the train load can seldom exceed 100 tons. Freight moved under such conditions must necessarily be costly and consequently the rates are so high that they put an excessive tax upon certain industries away from water transportation. The first general railway in England was promoted by the people of Manchester because they needed cheaper and more expeditious carriage of freight from the seaboard at Liverpool, 40 miles distant. All these years since the Liverpool and Manchester Railway was opened the freight rates have continued to be excessively high, so that in self-protection the Manchester merchants a few years ago, at an enormous expense, built a ship canal between Manchester and Liverpool so that ships could bring cotton and other raw material to the city where it is manufactured into cloth, etc. If the railways between Manchester and Liverpool had built cars capable of carrying thirty tons and made locomotives that would haul one thousand tons, they could have moved the freight so cheaply as to defy the competition of water routes. There is a large canal between Manchester and Liverpool built before railways were introduced and which is principally devoted to the transportation of coal.

During the agitations that have been periodically raised about deepening the Erie canal, the New York Central people have offered to carry all the freight that the canals could transport for the interest on the money proposed to be spent upon the canals. If the railway companies with lines between Manchester and Liverpool had been as enterprising as their American compeers and had known how cheaply freight could be transported by large capacity cars and powerful engines, they would have introduced new and improved methods which would have rendered the construction of a ship canal unnecessary. But the railway managers acted as if the primitive methods of railway operating were perfection, and a great opportunity was lost. It was the custom to move freight in small driblets that cost about five cents per ton per mile and the shippers had to pay the high price for they could not help themselves. If the railway managers had displayed the enterprise that other business men must practice to achieve success, they would have found out the cost of moving freight in other countries and that might have moved them to adopt a new policy; but they had no desire or inclination to depart from the ways of their predecessors and so they moved along in the old rut.

INTRODUCTION OF HEAVY FREIGHT CARS.

To change the terminal facilities of the great railways of the United Kingdom to provide for the use of thirty-ton cars would be a stupendous undertaking, but it would not have cost a ruinous sum to change the sidings in Liverpool and Manchester so that large capacity cars could be accommodated. However, the will for such enterprise was not present with the men who could carry it out and it probably never was thought of.

A move has now been made to introduce heavy freight cars upon the railways of the British Isles, and the success achieved by one line is leading others to follow. The railway managers of the British Isles are very much like sheep. When one breaks away from the beaten path and finds pastures that promise to be rich, the others follow at a break-neck pace.

A few years ago Mr. John F. McIntosh, locomotive superintendent of the Caledonian Railway, prevailed upon his directors to permit him to build two 30-ton freight wagons as an experiment. The cars were put into special service where they could be fully loaded and they did so well that others were ordered and the prospects are that a large proportion of the minerals and other heavy freight moved by the Caledonian Railway will be carried in thirty-ton cars. The other enterprising railway companies are profiting by this success to do likewise. Large capacity cars will never be used to carry all the freight on British railways as they are used in America, but a great improvement will be gradually effected. At present the greater part of the coal is carried in cars of about 8 tons capacity belonging to private owners and it will be almost impossible to induce these people to adopt larger cars for their yards and sidings are not adapted for long cars.

SCRAP STEEL CARS FROM THE UNITED STATES.

The Caledonian Railway Company had a most annoying experience with a lot of steel cars which they ordered from the United States. Their large cars were earning so much money that the management were anxious to put more into service as expeditiously as possible, and they contracted with one American firm which promised delivery in twelve weeks. To begin with they were not delivered for twelve months, and after they arrived in the Clyde the workmanship and material were found to be so bad that the company refused to accept them, and they are now lying in a yard with a good prospect of being sold for scrap steel. I have examined the cars and they show evidences of scandalously bad workmanship. I have a collection of photographs of these cars which will show our readers the kind of work some American car builders try to push upon British railways. The thing has done a great deal of harm to American steel car builders, for many railway officials went to see the cars and the conclusion that most of them came to was that they would not look to the United States when they were ordering steel cars.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

New York Central Air Brake Instruction Car.

We illustrate herewith some views of the New York Central's new air brake instruction car which has been in commission about two months.

Instruction cars are necessarily very similar and we do not believe it advisable at the present time to discuss fully the detailed equipment of this car. However, we would call attention to a decidedly new feature in cars of this kind. The roof, as shown in the illustration, is fitted with hatchways, or ventilating trap doors, which give both light and ventilation to the instructor and his classes. These hatchways are each four feet long and two feet wide, and are eight in number. This design is eminently advantageous and satisfactory, and should be copied by all cars of this kind in future building.

THE NEW YORK CENTRAL INSTRUCTION CAR—THE INSTRUCTOR AND HIS ASSISTANT "HAVING OUT" A DISPUTED POINT.

Air Brake Associations' Achievement.

In a prominent place on its editorial page, the *Railroad Gazette* writes forcibly on the "Economies of the Brake," and has to say in substance as follows:

"Out of the mouth of babes and sucklings hast Thou ordained strength.—Psalms, 8.2."

We suggest this as a proper motto for the Air Brake Association, at least for a few years to come. Its appropriateness lies in two facts: The Association is the youngest of the important mechanical societies. It is teaching the superintendents of motive power, the superintendents of transportation, the general superintendents and the general managers a lot of things which they never knew before. No doubt those higher officers read carefully the reports and discussions of this youthful body. If they do not, they neglect an important part of their training in the progressive art of railroading.

Then the *Gazette* continues, in discussing the subject further, to forcibly and plainly set forth the brake situation from a practical standpoint, showing an unusual intimacy with the subject. It points out the fact that the air brake art has not been completed and closed up as some of the higher officers seem to think, but that it remains indefinitely open and is continually growing. It doubts if railroad officers at large yet grasp the real importance of the air brake as a part of the general machinery of the railroad which goes in an economic way to promote higher speeds, quicker transportation of goods, greater use of cars, etc.

It points out that it is possible to move trains over the road more rapidly and safely. It also draws the attention of railroad officials to the fact that the air brake is not alone a safety device for preventing accidents, but that it also helps to the greater end of swelling the net revenue of railroads.

One important consideration given by the editorial is the fact that better air brake service does not necessarily mean further improvements and additional invention in the parts of the air brake valves, etc.; but that further advantage to railroads coming from the air brake must come from the more intelligent use and more systematic and skilful care of the air brake equipment now in service.

Quite a compliment is paid the Air Brake Association by this editorial. The motto suggested is a fitting auxiliary to the present one, "To obtain a higher efficiency in air brake service," if it be intelligently taken and not flaunted vaingloriously.

This editorial presents food for thought. From its conspicuous and authoritative position in the railroad world, the *Gazette* informs the Air Brake Association that the work of that young and energetic body is effectual and is being appreciated by railway officials. The assurance of this achievement is highest praise. Again, in order that this Association may continue its good work, it would do well to call the attention of its members to greater and continued thoroughness of investigation and accurate and reliable reports. The Association should avoid basing its rec-

THE NEW YORK CENTRAL INSTRUCTION CAR—THE EMPIRE'S ENGINEER TELLING HOW THE VALVE ACTED.

ommendations on isolated cases, and should take as a basis those cases best serving the general good and general practice. It should not be too quick in its deliberation and decisions, and should be very observant and unusually careful in recommending practices to the larger associations. Thus it will indefinitely re-

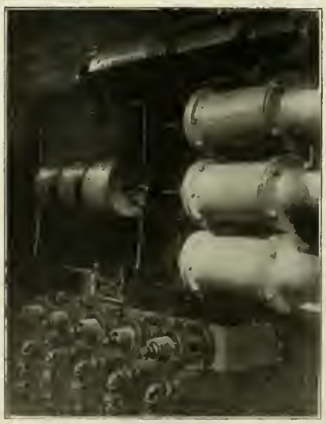
NEW YORK CENTRAL INSTRUCTION CAR — ROOF OF CAR. HATCHES RAISED.

tain the high position it now occupies and the good opinions above expressed.

CORRESPONDENCE.

Temporary Air Brake Inspectors.

I have noticed the editorial in your last number on the disappointing showing of a temporarily appointed air brake inspector. I can say that a similar case has come under my observation where a man has been temporarily appointed air brake inspector and sent out to do the work of a regularly appointed inspector. The results he has obtained are similar to those men-



NEW YORK CENTRAL INSTRUCTION CAR. —THE DEFECTIVE TRIPLE VALVE RACK.

tioned in your editorial. He has been unable to make a good showing because the men look upon him as a man only temporarily filling the place, carrying no weight or responsibility and who will shortly be placed back on his engine. He carries no prestige whatever with him, and is therefore unable to effect results. It also seems to the men that this man has been put in a place to merely fill it, because someone is expected to be in that position, and he has not really been placed there for any other purpose than to fill the place.

Were another man regularly and permanently appointed to this place, there is so much work that he could do that the railroad could not but see that the air brake subject is an important one, and that very substantial results therein can be accomplished by a good man in the right place.

T. B. WATSON.

St. Paul, Minn.

Air Brake Inspectors.

I note what you say in your last number about the temporary appointment of a general air brake inspector. It is undoubtedly true that a man thus temporarily appointed to the position carries little, if any, weight

NEW YORK CENTRAL INSTRUCTION CAR.—INTERIOR VIEW, SHOWING THE HATCHWAYS OPEN.

with him in his endeavors to perform the actual and responsible duties of a general air brake inspector. Unless he is given full power, held strictly accountable for the duties of his office, and backed by some interested higher official, his work will go for naught.

Take the case of the master mechanic or superintendent of motive power who is merely placed temporarily in the position for a short time, and who is not regularly appointed and supported by an interested higher official. His work will amount to very little, for nobody looks upon him as a person of authority, but rather as a man merely put in temporarily to fill a vacant position until someone better and more suitable to the position than he can be found. This introduces the man as a person of inferior ability and handicaps him with a stamp of inferiority that does him no good and will very shortly prove his work defective and inferior. The same may be said of the temporarily appointed air brake inspector; and no road who wishes a better performance of their air brakes, and wishes to put them in the hands of a competent man, will appoint a man temporarily. Make the place one of responsibility and important and put a good man in it.

AMOS JUDD.

Boston, Mass.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(179) J. F. McG., Corbin, Ky., asks:

Why is the equalizing port put in brake valve? A—The equalizing port is put in the brake valve to charge and feed chamber D and the equalizing reservoir in running position at the same time the train pipe is being charged. In full release position it assists port *c* in performing the same work.

(180) W. A. S., Michigan City, Ind., asks:

Is the working parts of the Westinghouse 11-in. air pump just the same as the 9½-in. pump? A—They are practically the same, with the exception that the parts of the 11-in. pump are proportionately enlarged.

(181) J. F. McG., Corbin, Ky., writes:

With the main reservoir on the tank, suppose the air hose was coupled up wrong between the engine and tank, coupling main reservoir to train line and train line to main reservoir, could brakes be oper-

ated, and how? Could a service or emergency stop be made? Could brakes be released? Could excess be carried? D5 and D8 brake valve. A—With the hose couplings wrongly coupled, as you describe, it would be impossible to practically operate the brake, either to apply or release.

(182) B. J. L., Chicago, Ill., writes:

You say in No. 166, July issue, that when the main piston of the 8-in. pump is moving down, there is steam on top of the reversing piston. Is it not true that when the main piston is moving down that both sides of the reversing piston are connected to the exhaust? A—Our answer to question 166 is in error, and should have stated that when the main piston is moving downward, there is exhaust steam on both the top and lower sides of the reversing piston.

NEW YORK CENTRAL INSTRUCTION CAR.—A PORTION OF THE OFFICE.

(183) T. J. S., Chicago, Ill., asks:

Why will the pump start by taking the plug out of the bottom end? A—Frequently the head will stick and hold fast against gum and sediment on the face of the bottom head. Again, the suction valve is sometimes pretty well fast to its seat, and is difficult to break loose; but after once lifting, will not stick as fast as before. The taking out of the plug gives a free entrance for air into the bottom end of the cylinder, thereby permitting the pump to be started when otherwise it would be more difficult to do, and is sometimes impossible.

(184) A. J. M., Montreal, Can., writes:

I have been advised to apply to you for information regarding tools for truing triple piston bushings and also for fitting triple piston rings to avoid springing. They advised me to apply to you for a copy of the Air Brake Proceedings, Nashville, 1897. A—Since the advent of long freight trains, it has been found impossible to satisfactorily fit these packing rings by hand for such service, as was done several years ago when the trains were very much shorter. We would discourage you from attempting to do this work by hand, and instead to have the triple valves sent to the manufacturer s works to have the work done.

(185) J. F. McG., Corbin, Ky., asks:

Why is the engineer's brake valve reservoir supplied with two ports instead of one? A—In the full release position the brake valve has two ports conveying pressure from the main reservoir to the chamber D and the equalizing reservoir. In the running position there is only one. In the full release position, the two ports supply pressure more quickly to the top of the equalizing piston, and thereby hold down the piston against the larger volume of pressure going to the train pipe, which tends to raise the piston from its seat. Even then the charge on the underside of the piston is greater on a short train than that on the top, and will cause the piston to rise and produce a flash at the angle fitting of the brake valve. In the running position, one port, equalizing port *g*, is sufficient to feed pressure to chamber *D* and the equalizing reservoir.

(186) J. F. McG., Corbin, Ky., asks:

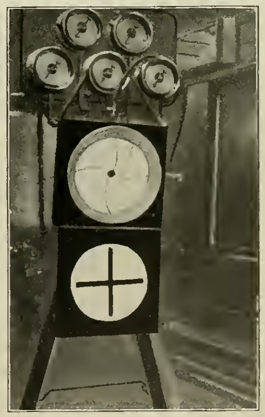
Why is it when you make a 5-lb. reduction and 5-lb. passes from the auxiliary to the brake cylinder, and train line and auxiliaries are equalized, the triple piston moves up to the slide valve and closes the graduating valve and stops? Why does it not move the slide valve? A—The reason the slide valve is not pushed to full release position when the triple graduates is because the auxiliary reservoir pressure on the back of the slide valve holds the valve to its seat, and supplies a certain amount of friction between the slide valve face and its seat. At the same time the equalizing pressure in the auxiliary reservoir is gradually and almost infinitesimally being compressed by the movement of the triple piston from graduating to lap position. There are two combined forces—

NEW YORK CENTRAL INSTRUCTION CAR.—A GLIMPSE INTO THE WASH ROOM.

that of the friction of the slide valve and that of the additional compression in the auxiliary reservoir, which prevent the triple from going to release and compels it to remain in lap position.

(187) G. W. F., Keokuk, Ia., asks:

Why is the small port drilled through the emergency valve piston of the quick action triple valve? This hole is not in all valves, and I note that it is only in some valves I have run across. A—All



NEW YORK CENTRAL INSTRUCTION CAR.—THE RECORDING GAUGE AND PRESSURE GAUGES.

passenger triple valves now furnished by the Westinghouse Air Brake Co. have the small port you refer to drilled through the emergency piston of the triple. All valves having this port are also supplied with a

packing ring. The reason for making this change is that as much train pipe air as possible may be sent from the train pipe to the brake cylinder in emergency application, and as little as possible leak past the outer edges of the emergency piston. These outer edges frequently wear quite rapidly and uncertainly, thereby letting a considerable quantity of pressure leak past in the emergency application. With the packing ring no air is supposed to leak past the edges of the piston, and all leakage is obliged to pass through the small port in the piston. The freight valves are not so equipped inasmuch that their train pipe is larger and there is less necessity for looking after the amount of air passing by emergency piston in emergency application.

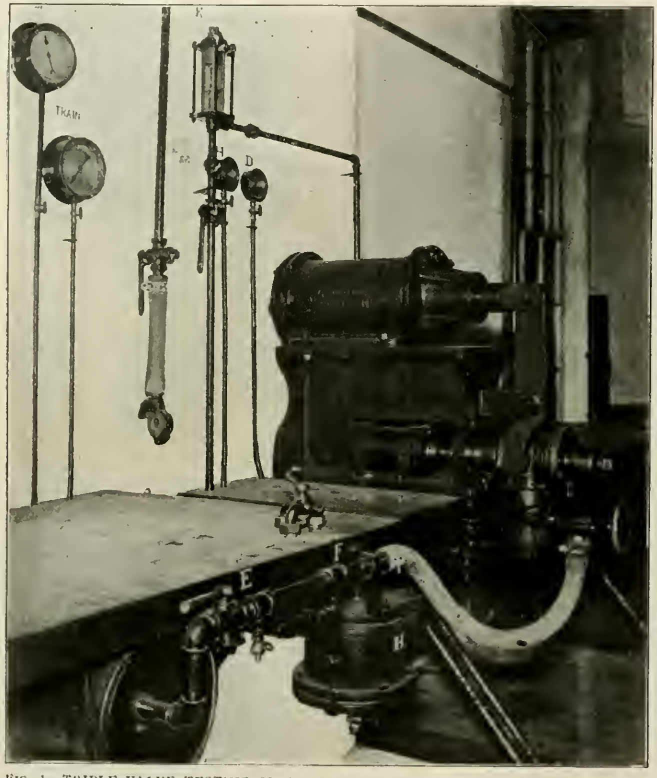


FIG. 1.—TRIPLE VALVE TESTING MACHINE, GREEN ISLAND SHOPS, DELAWARE & HUDSON RAILROAD.—COURTESY OF A. BUCHANAN, JR., MASTER MECHANIC.

(188) J. E. G., Needles, Cal., writes:

The question of plain or quick action triples for tenders has arisen, owing to poor service given on one of our large freight engines. Is it good practice to equip engines with quick action triples? Are there any roads that do so? A—There are no roads using quick action triple valves on their tenders in ordinary air brake service; but those roads using the high speed brake for their tenders are equipped with quick action triple valves. Some few roads now using the high speed brake, having equipped hurriedly, neglected to replace the old plain triple with a quick action triple at the time the change from ordinary brakes was made to high speed brakes. These roads, however, are now taking off the plain triples from their tenders and putting on the quick action triples. This is good practice. We do not feel that it would be good practice, however, to equip tenders in ordinary service, that is, not in high speed brake service, with quick action triple valves. If your tender seems to be so heavy that the plain triple valve does not do satisfactory work, it might seem better to increase your braking power through the medium of your foundation brake levers, rather than by changing the plain triple valve for a quick action valve. Possibly the tender needs a larger brake cylinder and it would seem so if your present brake arrangement does not hold well enough. If you could send us the loaded weight of your tender, a sketch of the foundation brake gear, the size of the brake cylinder and other important data we would be pleased to go over the matter for you and see what can be done to correct it and bring it up to its highest efficiency.

(189) T. J. S., Chicago, Ill., writes:

I wish to take exceptions to some statements printed in your June and July issues. The first one is No. 137 in the June issue. You say that the port leading to the atmosphere in the high speed automatic reducing valve is capable of reducing the pressure in the brake cylinder as fast as the graduating valve is capable of supplying it. This being a fact, it would not be possible to increase the brake cylinder pressure above 60 lbs. to the sq. in. This has been tested and the pressure in the cylinder can be run up to 70 lbs., or even higher, and the reducing valve will blow from 5 to 10 seconds. A—When the pressure is a trifle higher than 60 lbs. in the brake cylinder, the triangular port in the slide valve of the reducing valve begins to open at its smallest point. As the pressure increases, a wider portion of the triangular port registers with the port in the seat, thereby gradually giving a larger opening until the full opening is obtained. This wide open port was what we meant would exhaust the brake cylinder pressure as rapidly as the graduating port would supply pressure to the brake cylinder. Of course, until the triangular port is in register at its widest point, we cannot say that it is a full opening. This full opening is sufficient to discharge brake cylinder pressure as rapidly as the graduating port in the triple can send it from the auxiliary to the brake cylinder. The reason that five or ten seconds is required to reduce the pressure, as you mention, is because the triangular port is gradually moving in such a way that it becomes gradually smaller. The amount of pressure discharged would have escaped in much less time had the larger portion of the port been constantly open.

(190) J. J. O., Abbottsford, Wis., writes:

An engine equipped with a 9½-in. pump and a D-8 brake valve, carrying 70 lbs. train line and 105 main reservoir pressure and hauling fifty empties east and fifty loads of iron ore west, all air brake including caboose, would several times per day upon a service reduction of seven or eight pounds throw the entire train into quick action. This would only happen when the train had been charged up for some time and then only on the first application. This had been going on for several weeks and experiments had been made of cutting the tender brake out, then the driver, then both. Finally the brake valve was changed and the trouble disappeared entirely. An examination of the brake valve revealed nothing wrong, still it must have been there in the valve somewhere. A—Most probably the major part of the cause of your trouble lay in the brake valve; possibly the equalizing piston did not work as freely as it might. Again, it is possible that the movement of the piston might be a trifle impeded by the presence of small particles of grit or

sediment, or the piston might be tightly fitted. As you say that the trouble generally occurred at the time of first application when the train was fully pumped up, would lead to a belief that possibly there were leaks at the hose couplings or in the train pipes which were greater when the train was stretched and at the time of application of the brakes in service application. With the train thus stretched, immediately after shutting off the engine, the leaks would probably assist very much in making the reduction. Possibly this leakage was sufficient, when added to the reduction at the brake valve, to cause the cars nearest to this leak to jump into quick action and draw the others in also. This would seem a plausible solution of the problem, as a change of brake valves eliminated the trouble.

(191) T. J. S., Chicago, Ill., writes:

You state in your June issue that a leaky graduating valve will not release a brake without a slide valve leak. Admit this to be true under certain peculiar conditions. Your theory is no doubt that the slide valve will assume a position in which the port leading to the brake cylinder is lapped. Is it not a fact that a body in motion must be acted upon by a force equal or greater than the opposing force or the body will continue to move on? What will stop it then until the piston strikes against the wall of the chamber, that being release position? Is it not also true that more force is required to put a body in motion than that necessary to keep it moving? My theory is that if a triple slide valve starts to move from service toward release position, that it will go clear to release position. It has been tried and found that on four different triples with a thread drawn through the graduating port to keep the graduating valve off its seat, that it will release every time. These triples were new from Westinghouse works and released after a five-pound reduction in the train pipe. A—Unless the slide valve or its seat does leak, either a considerable or infinitesimal amount, a leaky graduating valve cannot cause the triple piston and slide valve in good condition to go to release position and let off the brake. As soon as the slide valve comes to that position on its seat where there is no opening between the brake cylinder and the atmosphere, there can positively be no leakage from the auxiliary reservoir to the atmosphere or brake valve unless there is a scratch or other leak in the face of the slide valve or its seat. The auxiliary pressure can flow past the leaking graduating valve or its seat, but can get no further than the slide valve face unless, as we say, there is an imperfection present which will permit an escape of this pressure. Otherwise it will be bottled up in the port in the slide valve, and will get no further. The piston and slide valve will not generally move to full release position after it has once been started from service position, because as the parts travel toward release, the air in the auxiliary reservoir is actually being compressed by the movement of the piston toward release. Of course this is a very small amount, but nevertheless is an actual compression, and will usually prevent the piston from going to full release. A piston and slide valve which works "jerky," however, might jump past lap. It is true that more force is required to put a body in motion than is necessary to keep it moving. The triples which you tested, while being new, undoubtedly had a small leak somewhere on the face of the slide valve or its seat, or else "jerked" into release because of the friction of the parts.

(192) J. I. M., Rensselaer, N. Y., writes:

In talking with an engineer he made the statement that he could stop a passenger train of four cars quicker than he could ten cars, running 50 miles an hour, everything else being equal (each coach weighing same, brakes being in first-class condition, quick-acting valves and cylinders alike). I claimed there should be no difference, with this exception, that the engine had more braking power in proportion to its weight than a coach, and the excess would be greater on our cars than ten, but he claimed that was not where the difference was, but said it was the weight of the trains. I asked him if it was possible to couple four or ten coaches together, 4 ft. apart, with a chain and have them that distance apart when the brake was applied? Would the rear coaches come together and shove the forward ones? He did not think so, that the coaches would stay apart. Please explain. A.—With two trains, one with a locomotive and five passenger coaches, and another with the same engine and ten coaches, precisely the same in condition, such as weight, braking power, brake shoes, etc., the longer train could be stopped in a shorter distance than the shorter train, the reason being that the coaches are braked to 90 per cent. of their light weight, and the engine is not braked so high. Usually the tender is braked to 90 per cent. of its light weight, the brake on the driving wheels to about 75 per cent. and the forward truck brake (if any) is braked to about 50 or 60 per cent. This leaves a greater percentage of unbraked power on the engine than it does on the cars. This percentage of unbraked weight of the engine must be held back by the brakes on the cars. Ten cars can hold back more than five cars can. Of course, there will be a little longer time consumed in applying the brakes on the ten cars than on the five, but this difference in time would not amount to any more than one-half a second at the most and would hardly be considerable. If the special train of five coaches, or ten, for that matter, was fitted up with long air hose and couplings so that the cars would stand four feet apart, as mentioned in your case, and brakes applied, there would be a tendency for the rear cars to be a trifle nearer together after the brakes were applied in quick action than would the forward cars, but this would also be very small and perhaps inconsiderable. The cars would certainly be apart and would not run together. The quick acting feature of the triple valve would apply the brake quicker than the slack could run in.

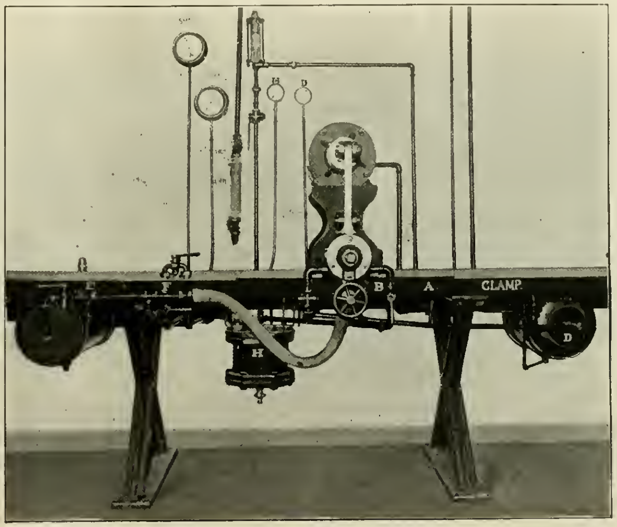


FIG. 2.—TRIPLE VALVE TESTING DEVICE, GREEN ISLAND SHOPS, DELAWARE & HUDSON RAILROAD.—COURTESY OF A. BUCHANAN, JR., MASTER MECHANIC.

Compound Consolidation Engines for the Denver & Rio Grande.

The Denver & Rio Grande Railroad has recently bought 30 consolidation engines of the Vauclain compound type from the Baldwin Locomotive Works and also some 10-wheel engines. The cylinders of these consolidations are 17 and 28 in. by 30-in. stroke with low pressure cylinder on top. The driving wheels are 54 in. in dia., and the total weight is 188,095 lbs. The work cut out for these heavy machines is between Denver, Pueblo and Salida. The first district of this division, between Denver and Pueblo, is about 120 miles long and is over the "divide" separating the South Platte and the Arkansas rivers. From Pueblo to Palmer Lake there is a continuous rise of 2,569 ft. in distance of 67 miles, and from Palmer Lake to Denver, the remaining 53 miles, a descent of 2,039 ft. is made. This means that in passing over the division an engine has a long, hard pull to the summit and a long, steady drift down the other side of the "mountain," both of which are a hard tax on the engine. The maximum grades between stations vary from less than 1 per cent. to 1.42 per cent., and the curves encountered in the steepest climbs are 6 degrees. From Toluca to Husted, a distance of 40 miles, there is no compensation in the grading to allow for the presence of curves, which adds to the work the engines are called on to perform. On the second district, from Pueblo to Salida, there is a continuous rise of 2,378 ft., the minimum grade being 0.66 per cent. and the maximum 1.42 per cent., with curves ranging from 3 deg. to 12 deg. 30 min.

In November, 1900, the Baldwin works supplied the Denver & Rio Grande with some very similar simple consolidations with 22x28-in. cylinders, 54-in. drivers and weighing 183,790 lbs. These engines were used on the Denver-Pueblo division, but the continuous climb for the first part of each trip necessitated double-heading to the summit of the divide, and one useless engine then drifting either home again or for the rest of the trip. It is expected that by the more economical use of the steam in the cylinders due to the compound feature of the new engines, together with the consequent lesser tax on the boiler, these machines will do away with the necessity for the doubling of engines going up the hill. Whether or not this anticipation is to be realized will be determined by actual test.

The engines in question have wide fireboxes, which is an innovation on the D. & R. G. The balanced piston valves are driven by direct connection gear, and the engine truck center castings have 3-point suspension links. The main and intermediate drivers are not flanged, and the stroke being 30 in. brings the center of the crank pin within 12 in. of the outside of the tire. The theoretical tractive power of these mountain climbers on level track at slow speed is about 43,180 lbs. The brakes were furnished by the American Brake Company.

A few of the principal dimensions are given below:

COMPOUND CONSOLIDATION.—DENVER & RIO GRANDE RAILROAD.

Cylinders, 17 and 28 x 30 in. Valve, balanced piston.

BOILER.

Type, straight. Diameter, 74 in.
Thickness of sheets, ⅝ in.
Working pressure, 200 lbs. Fuel, soft coal.
Staying, radial.

FIREBOX.

Material, steel. Length, 102⅛ in. Width, 65⅞ in.
Depth, front 70 in., back 62¼ in.
Thickness of sheets, sides, $\frac{5}{16}$ in., back, ⅜ in., crown, $\frac{5}{16}$ in., tube, ½ in.
Water space, front, 5 in., sides, 5 in., back, 5 in.

TUBES.

Material, iron. Wire gauge, No. 11.
Number, 344. Diameter, 2 in. Length, 14 ft. 6 in.

HEATING SURFACE.

Firebox, 172.5 sq. ft. Tubes, 2,596 sq. ft.
Total, 2,768.5 sq. ft. Grate area, 46.75 sq. ft.

DRIVING WHEELS.

Diameter outside, 54 in. Journals, all 9½ x 12 in.

ENGINE TRUCK WHEELS.

Diameter, 30 in. Journals, 6 x 12 in.

WHEEL BASE.

Driving, 15 ft. Total engine, 23 ft. 10 in.
Total engine and tender, 53 ft. 6½ in.

WEIGHT.

On driving wheels, 163,445 lbs.
On truck, front, 24,650 lbs. Total engine, 188,095 lbs.

TANK.

Capacity, 6,000 gals.

TENDER

Wheels, diameter, 33 in. Journals, 5 x 8½ in.

The Imperial Military Railways.

On July 1 last the railways of the Transvaal and the Orange River Colony passed from the department of the army in South Africa into the hands of the civil government. The railways of the two colonies will continue to be worked together, but the name, Imperial Military Railways, has been changed to that of the Central South African Railways. For a time, however, the system of modified military control, says the Johannesburg *Star*, which worked so well in Cape Colony and Natal, will be retained. Col. Sir Percy Girouard, who has had extensive experience on Egyptian and Soudan railways with Lord Kitchener and who was the military director of the South African railways during the war, has been retained by the civil government as commissioner of railways.

In the war between France and Germany in 1870, the latter country adopted a system of railway control by which the actual working of the roads was left to the civil staff. In the Orange River and Transvaal this system could not be applied. The staff of the Netherlands Railway in particular declined to serve, and the work had to be undertaken by the army of occupation.

When the report of the commissioner is published it will be interesting to have the complete figures of the numbers of men moved by rail in the last two years, the tons of supplies distributed over the whole system, the guns and horses transported and the heavy ambulance work which was done. From the first a considerable civil population had to be provided for, and a large amount of construction work was undertaken in the interest of that population. The coal line along the Rand was completed all but laying the rails. This work will not only be of great benefit in the future, but while being built, provided employment at a critical time for 10,000 natives. The difficulties encountered in keeping the railway lines open even after the blockhouse system had been inaugurated will, we feel sure, form a very interesting chapter in the commissioner's report.

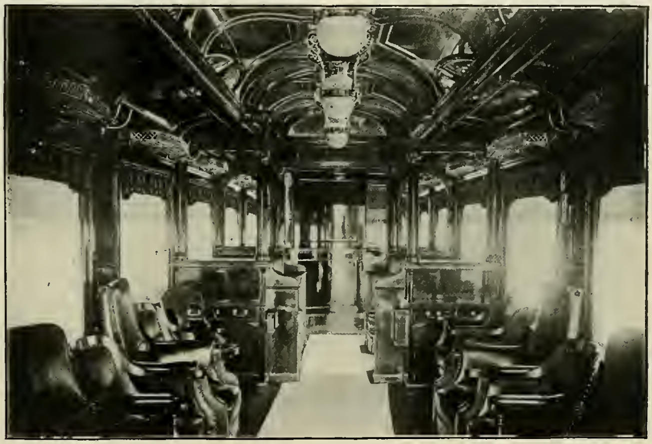
BAGGAGE, BUFFET AND STATE ROOM CAR.—N. Y., N. H. & H.

New Passenger Equipment on the N. Y., N. H. & H.

Through the courtesy of Mr. William Appleyard, master car builder of the New York, New Haven & Hartford Railroad, we are enabled to present to our readers some information concerning the handsome passenger coaches recently built at the company's New Haven shops for service on the Knickerbocker Limited, running between New York and Boston in 5 hours. These cars are thoroughly well built and are similar in style and decoration to those constructed by the Pullman company for the Bay State express about two years ago.

The baggage car, or rather baggage and state-room car, shown in the illustration, consists of a modern baggage compartment, occupying about half the car and a passenger compartment in which is a buffet and two state-rooms with toilet rooms attached. The state-rooms have each two comfortable easy chairs and a sofa, the latter is divided into three seats by arm rests which, turning upon a hinge, can be moved out of the way, after the manner of English arm rests in first-class carriages, and this transforms the three-seat sofa into a reclining couch.

The observation car contains at one end a parlor with revolving chairs. These chairs do not interfere with one another, even if rotated in opposite directions or brought back to back, a feature which passengers no doubt appreciate very much. These seats are so arranged that it is possible to put up an individual table, which one person can use. This



SMOKING ROOM AND BUFFET, KNICKERBOCKER LIMITED.—N. Y., N. H. & H.

also is a most satisfactory arrangement. An auxiliary buffet occupies the center of this car, the rear end of which is a handsomely furnished and comfortable smoking room. The general interior of this car is mahogany, decorated with inlaid work, while the smoking compartment is finished in quarter-sawed English oak, also inlaid. The color scheme all through is most artistic, the various shades are harmonized in a way most pleasing and restful to the eye. The head lining used in the observation parlor is made of glued-up whitewood veneer, painted and decorated. It is known as the "groined" style of ceiling from the fact that the panels are arched from all sides, the arches intersecting and forming groins.

These cars have structural steel platform timbers, if one may be allowed to say so, which add very much to the strength of the underframe, and in case of severe shock there is nothing to break up and splinter. A feature of the buffets is a Pintsch gas range, which is supplied with gas from the same reservoirs as the lighting system draws from. The two gas holders under the car each contain 213 cu. ft. at a pressure of 10 atmospheres.

A glance at the illustrations will show that outside decoration has been reduced to a minimum, the finish, however, is excellent, like "beauty unadorned, is adorned the most." These cars are elegant, convenient, strongly constructed, and handsomely furnished, and should give the greatest possible satisfaction both to owners and patrons for many years to come.

The Fort Wayne Electric Works, Fort Wayne, Ind., have issued a folder in which the merits of the "Wood" power circuit arc lamp are set forth. This lamp operates on 220 to 250 volt or 500 to 550 volt direct current circuits with two to five lamps in series across the line. The lamp is made in various styles and sizes. Send for the folder if you are interested.

OBSERVATION CAR, KNICKERBOCKER LIMITED.—N. Y., N. H. & H.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters in the waste basket.

(154) E. H. B., Little Rock, Ark., writes:

In disconnecting a piston valve, with engine to be used on one side, can the valve simply be pushed ahead or back in the steam chest, and will it stay in that position without fastening? A.—There is no tendency to move a locomotive valve, either slide or piston, caused by the steam in the steam chest, but it is not good practice to leave the valve without blocking or fastening in some way, because with a disconnected engine one cannot be sure that no unforseen complications will arise. With valve pushed to one end of chest, the cylinder is always full of live steam from one end. You can come home with valve in the center or at one end, but the safer way is to block or fasten the valve every time, after choosing its position. A piston valve with an extension rod in front if pushed forward and not blocked might be forced back if the engine struck some object on the track.

(155) Crosshead writes:

I was running an 18x24-in. ten-wheel Schenectady engine in heavy freight service and broke the bottom inside crosshead gib on the left side, which left an opening of 1¼ in. between guide and crosshead. Could I have done heavy switching in back motion without running grave risks of doing more serious damage?—A. From your description we imagine you had one good gib on outside of crosshead. If the switching was very urgent you might have put in an oak gib, firmly secured, in place of the broken one, that is if you had time; but the safer course under the circumstances was not to work the engine heavily in back gear.

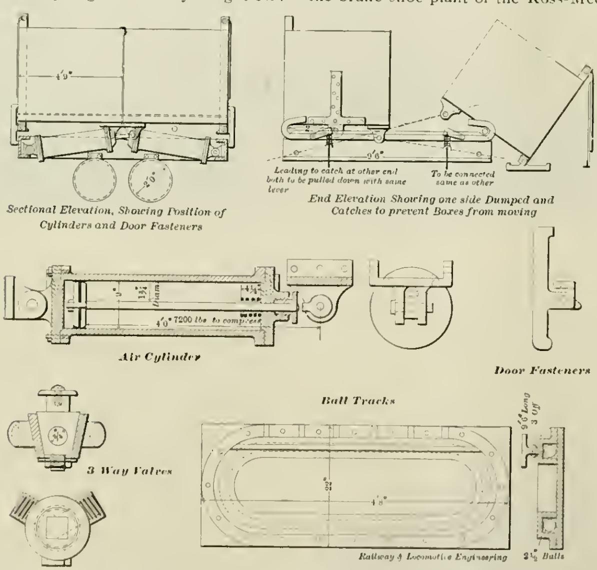
The American Brake Shoe & Foundry Company, of New York, have purchased the brake shoe plant of the Ross-Meehan Foundry Company, at Chattanooga, Tenn. The purchase will in no way interfere with the business of the Ross-Meehan Foundry Company and the Southern Malleable Iron Works, which are under the same management.

An Instantaneous Unloader.

A short time ago we were invited to view the Lawson improved dumping car at work in the Newark yard of the C. R. R. of N. J. The car used, is reproduced in our illustrations. It is made of wood, but steel will be the material of which these cars are to be built in the future.

THE LAWSON DUMPING CAR.—80,000 POUNDS CAPACITY.

The inventor is justified in calling it a dumping car; to use a slang expression, "it doesn't do a thing but dump." The Lawson improved dumper consists of an ordinary car frame upon which are mounted two boxes, each one the full length of the car and half its width; one box dumps to the right and the other to the left. The weather side of each box, as a nautical man might say, is hinged at the top and is kept tightly shut at the bottom by a simple and ingenious and very effective automatic stop which has no parts to get out of order and which keeps out of the way when not wanted. The box is carried upon hardened steel balls which run in an oval race. One side of the oval only carries the weight, so that the balls which are in service for one dumping give way to others, moving round the race every time the box is used, thus diminishing wear and most effectually preventing the grooving of the balls. The race casting is hung from the under side of the boxes, so that clogging or sticking is impossible. The movement of each box is provided for by two air cylinders, pivoted at their back ends so as to oscillate through the desired angle as the box goes over. When a box is to be dumped air is simultaneously admitted behind the pistons of the two push cylinders, and the box rolls easily out on the balls and hangs over the side of the car. Here two trunnions engage with a hooked catch, so that on applying more air pressure, the box tips forward, but without falling, and drops



DETAILS OF THE LAWSON IMPROVED DUMPING CAR.

the load, as a man might dump a hod of mortar. As the box was moved outward the side door-locks let go and the door being hinged at the top, offers no resistance to the full and complete discharge of the load. The box tips past the angle of rest of any known debris, and can be given whatever shock is required, as it turns over, so that if loaded with clay soft enough to make bricks, the whole of the sticky mass would reach the ground without having had time to expostulate.

In the matter of shock, we may say that inside the air cylinder at the piston-rod end there is a coil spring which takes 7,200 lbs. to compress it; this absorbs the shock caused by the box going over when dumped, as it can be, by hand. A certain amount of air, however, is introduced into this end of the cylinder which acts as a cushion of the most approved and being extremely simple and substantial it should not cost very much to build or to keep in service and hard at work all the time. It can, of course, be unloaded by an operator on the engine or by a man on the car when detached from the locomotive. It can be dumped by hand if by any chance the air gives out. It can handle all kinds of rough freight as well as material for railway construction and handle it all economically. The train line air pipe fills the brake auxiliary reservoirs first, and then fills two large reservoirs for the dumping mechanism. The car positively cannot be dumped by accident. It must be unloaded knowingly by a person intending to do so. There are two automatic trip levers which hold the boxes in place back to back, and there they stay.

The Lawson steel car can handle any

INSTANTANEOUS DUMPER CAUGHT IN THE VERY ACT BY AN INSTANTANEOUS CAMERA.

kind. The inventor intends to adopt a simple arrangement whereby, toward the end of the stroke, air will be automatically introduced into the front end of the cylinder something on the principle of the hydraulic recoil apparatus used on quick-firing guns, so that the boxes on the car may be tilted suddenly, or without shock, or held rocking at any angle required for the comparatively slow dumping required in a moving train. After discharging, the box is tilted back and drawn in over the smooth steel balls until in place, when the door-locks hold the sides in place, and the car is ready for another load. The car can be dumped and boxes returned ready for another load in less than one minute, so that perhaps with full regard to flawless truth it is not absolutely correct to say that it is instantaneous.

This car, made of steel, will very materially reduce the cost of construction, material, hot or cold, and just here a very useful function for this car looms up. A few Lawson steel dump cars made, as is quite possible, of any desired height, could be run close in, below a steel trestle on the ash track at a round house. Engine ash pans may be raked out so that the material will drop directly into these cars, a spray of water cooling the hot ashes. After filling, the cars may be taken away, dumped without loss of time and brought back to serve the same useful purpose again. Used this way, the man who rakes out, loads the cars, and as the dumping is the work even less than one minute—not absolutely instantaneous, mind you—the tedious loading and unloading of ashes at an engine house by a gang of men, ceases to be the serious or expensive matter it is now. Handling locomotive ashes fresh from the ash pans, the Lawson cars are "hot stuff." In construction work they throw their load out hard, that's what the word "dump" means. They do not depend much on gravity, they are dump cars.

Locomotive Rating.

The weight of a train is made up of two components, the weight of the cars and the weight of the paying load. All this weight is mounted on wheels, and other things being equal, the fewer the wheels the total weight is carried on, the greater the paying load. An engine gives a certain definite drawbar pull, and it rests with those in authority to use that drawbar pull to the best advantage. A train, the weight of which is 1,000 tons, made up of 20-ton cars, may be hauled by an engine developing maximum drawbar pull. In such a train there would be 50 cars, with a total of 200 axles. If this total weight had been disposed in 70-ton cars there would be only 14 cars in the train, 56 axles, and about 33 to 40 per cent. of the available drawbar pull would not have been utilized, though the 1,000 gross tons would go over the division. There are a number of good reasons given for this state of affairs by Mr. J. M. Daly in a pamphlet in which he explains the operation of his quick action train resistance computer. He points out that for long trains of light loaded cars the company usually makes a "concession to the engine," that is, the company permits the engine to haul something less than the theoretical rating which stands against it; but in case of short trains of heavily loaded cars, the engine, he says, should make some concession to the company. The whole matter in a nutshell is: How to use the whole of the available drawbar pull every time and in no case overdo it.

Mr. Daly has devised a cabinet for the purpose of facilitating the "making up of

trains" in which blocks of wood representing cars of various gross weights are capable of being grouped so that the total resistance in every case is the thing considered. When the groove in which the blocks are placed is filled up to the engine rating figure, the proper train has been indicated, whether it be long or short or whether carried in light or heavily loaded cars. Much time and labor are said to be saved thereby.

The Train Resistance Computer Company, Woolmer Building, Peoria, Ill., are prepared to forward the pamphlet referred to, or to give inquirers any information which they may desire.

The Pocono Mountains.

The Lackawanna Railroad has issued a neat little pocket folder, dealing with what the officials call their Pocono Mountain Special. The run from Hoboken to the summit is fully described. Here in the mountains the air is cool, bracing and invigorating, for the altitude is more than 2,000 ft. Although the Lackawanna engine, powerful as it is, has brought a train of luxurious cars, weighing many tons each, up into the heart of these highlands, it has not been able to elevate the thermometer. That refractory article is stated, upon good, expert authority, to be fully 10 degrees below New York city at the end of the journey. The folder shows, in excellent little half-tones, a party of golfers at Delaware Water Gap, an angler standing in mid-stream, with taut line and bowed rod, in one of the famous trout streams of "Lackawanna Land," if we may so name this region. A scene on Lake Lenape, and a tally-ho party on Mount Pocono, form part of the series. Information is given about the train for week end trips, with condensed time table for east and west. D., L. & W. is the way to spell the name of the road, pronounced Lackawanna, 429 Broadway, New York.

The "Straight Tip" on Tips.

A new burner has been perfected by the Safety Car Heating & Lighting Co. It is called the Hexagon Tip. Through its use the illumination afforded by a standard Pintsch lamp can be increased by about 40 per cent., while the additional consumption of gas amounts to something less than 10 per cent. The Tip is applicable to any standard 4-flame Pintsch lamp—of which there are 140,000 in use. One large railroad system in the East has already had many of their lamps fitted with the new burners, and all tips hereafter ordered by that company will be of the new type. The catalogue number of the new fitting is No. 222a. The general office of the company is 160 Broadway, New York. Send for further information if you want it.

DELAWARE WATER GAP, ON THE LACKAWANNA.

Combination Feed on Slotting Machine.

An ingenious workman succeeded in slotting the oblique portions of a locomotive frame by combination feed, says the *American Machinist.*

In a certain large locomotive works there is a double-head slotter running night and day shaping locomotive side frames, many being of the type having several surfaces at oblique angles, the obliquity differing. The oblique surfaces in a large number of these frames were machined by moving one end of the frame off the table and placing it on horses, thus bringing these surfaces into line with the normal tool travel. It is evident that this was a costly operation. Lately a set of frames were removed from the large double-head slotter and it was found that the oblique surfaces were all nicely finished. It was done by using the lateral and longitudinal feeds simultaneously. The combinations thus obtained caused the point of the tool to travel in the direction desired, taking both roughing and finishing cuts and producing a very fine piece of work. One oblique surface shows a ratio of 3 to 1; so feed gears having six teeth for the longitudinal to two for the lateral feed were used, and similarly with the others.

Must Be the Best.

Drummer—Let me sell you some good glue, sir; we handle a very fine quality.

Customer—I want only the best kind, remember.

Drummer—Ours is what the railroads use to stick down their coach windows with! *(Large order booked.)*

Of Personal Interest.

Mr. H. D. Judson has been appointed superintendent of the Illinois Lines, with headquarters at Galesburg, Ill.

Mr. J. W. Walker has been appointed superintendent of terminals of the Atchison, Topeka and Santa Fe Railway at San Francisco, Cal.

Mr. N. L. Rand has been appointed master mechanic of the Intercolonial Railway of Canada, with headquarters at Moncton, N. B.

Mr. J. M. Robb has been appointed superintendent of motive power of the Canadian Northern Railway, with headquarters at Winnipeg, Canada.

Mr. H. D. Hunter has been appointed division superintendent of the Missouri Pacific Railway at Osawatomie, Kan., vice Mr. E. J. Ward, resigned.

Mr. G. F. Malone has been appointed assistant superintendent of car service of the Baltimore & Ohio Railway, with headquarters at Baltimore, Md.

Mr. R. R. Sutherland has been appointed general superintendent of the Cincinnati, Richmond and Muncie Railroad, with headquarters at Muncie, Ind.

Mr. John R. Christie has been appointed road foreman of engines of the San Francisco and San Joaquin Valley Railway; headquarters, San Bernardino, Cal.

Mr. W. B. Throop has been appointed superintendent of the Chicago Division of the Chicago, Burlington & Quincy Railroad, with headquarters at Aurora, Ill.

Mr. J. L. Forepaugh has been appointed superintendent of the Breckenridge Division of the Great Northern Railway, with headquarters at Breckenridge, Minn.

Mr. R. M. Kimber has been appointed superintendent of the Galesburg Division of the Chicago, Burlington & Quincy Railroad, with headquarters at Galesburg, Ill.

Mr. John D. Jones has been appointed master mechanic of the Washington and Columbia River Railway, with headquarters at Walla Walla, Wash., in place of Mr. J. W. Ashton, assigned to other duties.

Mr. L. W. Bowen has been appointed assistant superintendent of the Northern Division of the Great Northern Railway, with headquarters at Grand Forks, No. Dak.

Mr. W. J. Griffin has been appointed assistant superintendent of the Denver and Rio Grande Railway at Salida. Col. He was formerly trainmaster on the same road.

Mr. George McL. Brown has been appointed superintendent of the sleeping, dining and parlor car department of the Canadian Pacific Railway, vice Mr. J. A. Sheffield, resigned.

Mr. J. W. Sherwood has been appointed manager of the Union Station and Terminal Association of Detroit, Mich. He was formerly general superintendent of the Detroit Southern Railway.

Mr. A. E. Welby has accepted the position of general manager of a new railroad to be built in Peru, from Arroya to Cerro de Pasco. He was formerly superintendent of the Rio Grande Western.

Mr. J. B. Flanders has been appointed general superintendent of the Detroit Southern Railway with headquarters at Detroit, Mich. He was formerly general superintendent of the Cincinnati Northern.

Mr. M. V. Ham, foreman of locomotive and car departments of the Texarkana and Ft. Smith Railway at Beaumont, Tex., has been appointed master mechanic of the same road, with headquarters at Texarkana, Tex.

Mr. T. P. Cullen has been appointed superintendent of the San Pedro, Los Angeles and Salt Lake Railway, with headquarters at Los Angeles, Cal. He was formerly with the Northern Pacific at Helena, Mont.

Mr. B. F. Egan has been appointed superintendent of the Kalispell Division of the Great Northern Railway, with headquarters at Kalispell, Mont., vice Mr. L. W. Bowen, acting superintendent, who has been transferred.

Mr. G. J. Bury has been promoted to be a general superintendent on the Canadian Pacific Railway. He was formerly superintendent of the Lake Superior Division of that road, which position will now be filled by Mr. R. Chapple.

Mr. Geo. McGill has been appointed road foreman of engines on the Mohawk Division of the West Shore Railway, vice Mr. M. C. Dean, who filled that office for two years successfully and has now gone back to his old run.

Mr. F. C. Rice has been appointed general superintendent of the Chicago, Burlington & Quincy Railroad, with headquarters at Chicago, Ill., vice Mr. J. D. Besler, who has been transferred to the staff of the second vice-president.

Mr. A. Price has been appointed superintendent of the Canadian Pacific Railway on the lines west and north of Toronto Junction, with headquarters at Toronto, Ont. He was formerly division superintendent on the same road.

Mr. D. E. Barton, at one time master mechanic of the Dunmore Shops of the Erie Railroad (formerly the Erie and Wyoming Valley), but later with the Baldwin Locomotive Works, has been appointed general master mechanic of the Atchison, Topeka & Santa Fe Railroad, with headquarters at Topeka, Kan.

Mr. H. W. Clarke has been appointed superintendent of transportation of the Mobile & Ohio Railway, with office at Mobile, Ala. He was for twelve years superintendent of the St. Louis Division of the same road, which position will now be filled by Mr. E. W. Moore, heretofore trainmaster of that division; headquarters. Cairo, Ill.

Mr. Wm. L. Kendrick has resigned the position of foreman painter of the New York, Susquehanna and Western Railway at Stroudsburg, Pa., to accept one in the new Penna. R. R. Y. M. C. A. building at Conway, near Pittsburg. Mr. Kendrick leaves a host of friends who showed their appreciation of his many kind acts by the gift of a neat gold watch.

Mr. A. E. Mitchell has accepted the position of superintendent of motive power of the Northern Pacific Railway, with headquarters at St. Paul, Minn. Mr. Mitchell was for many years superintendent of motive power of the Erie Railroad, which road he left last November to become assistant superintendent of the Chicago, Milwaukee and St. Paul Railway.

Mr. A. A. Sharp has resigned as superintendent of the Memphis Division of the Yazoo and Mississippi Valley Railway to accept the position of manager of the Roundaway Manufacturing Company, of Mississippi, in which several officials of the Illinois Central are interested. Mr. J. T. Paul, formerly trainmaster at New Orleans, will succeed Mr. Sharp as superintendent of the Memphis Division, with headquarters at Memphis, Tenn.

Mr. W. L. Kellogg, for the past year road foreman of engines on the Arkansas Division of the St. Louis, Iron Mountain and Southern Railway at Little Rock, Ark., has been appointed master mechanic of the Missouri Pacific Lines at Fort Scott, Kan., at which point he started in years ago as a fireman. Before going with the Iron Mountain he was for a long time with the Chicago, St. Paul, Minneapolis and Omaha Railway. His many friends will be pleased to learn of his deserved promotion.

Mr. Fred Mertsheimer, superintendent of motive power and machinery of the Kansas City Southern, has been appointed superintendent of machinery of the Denver and Rio Grande Railway at Denver, Col., to succeed Mr. Henry Schlacks, resigned. Mr. Mertsheimer was for many years connected with the Union Pacific as master mechanic, division superintendent and superintendent of motive power. He left that road in August, 1897, to become superintendent of motive power of the Kansas City, Pittsburg and Gulf, and the following December he was appointed general superintendent of that road and

held the position until June, 1899 He remained as superintendent of motive power and machinery of the road and its successor, the Kansas City Southern, until October, 1901. Mr. Schlacks has been with the Denver and Rio Grande since December, 1893, and previous to that time was, for a number of years, superintendent of machinery of the Illinois Central Railway.

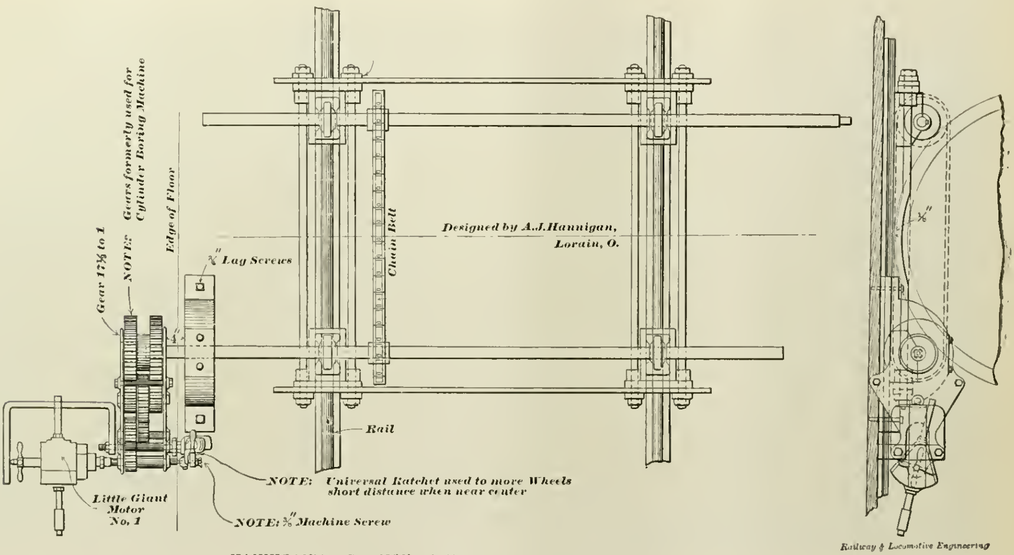
Valve Setting With Air.

BY A. J. HANNIGAN.

The accompanying illustration shows a valve-setting machine operated by a No. 1 Little Giant air motor. The gearing used was taken from an old-style boring bar and is geared 17½ to 1. The rollers are of cast iron, 6 in. in diam. and 2-in. face; they are held in position on the shafting by the use of gib-end keys recessed in roller hub at gib end to admit a 5-16-in. machine screw into the rollers. The gib end of the keys are let into the rollers sufficiently to allow the head of the machine screws to come flush with hub face of rollers. The keyways in the shafting are ½ in. longer than width of rollers to allow for lateral placing; this prevents the rollers from breaking or chipping off. Two sprocket wheels and chain belt are used to transmit motion to back rollers, and two stay plates of wrought iron are used to keep rollers from working sideways.

A most interesting feature of this machine is a left-hand ratchet attachment. Without this attachment the machine could not be termed a success. The ratchet is placed opposite the air motor and is held in place by a ⅜ machine screw which goes through center of ratchet into shaft. When main drivers are nearing dead center, the operator shuts off motor and uses ratchet to move wheels the remaining short distance. The use of this machine renders it possible for two men to set a pair of valves in four hours, to move all blocks and blades and set them in proper position.

The old pinch bar system requires six men, twelve hours to accomplish the same amount of work. This machine has been in constant use in the Cleveland, Lorain and Wheeling R. R. shops at Lorain, Ohio, since August, 1901, and has given every satisfaction. It was designed by the writer, now employed as machinist at these shops, and who hopes the day has at last come when bars are no more to be used for this kind of work. and that the design shown here may be helpful to fellow workmen by dispensing with the old pinch bar with its proverbial "bad heel," which we know by experience, once in a while, slips and causes the operator to "bless" the man who invented the pinching method.



HANNIGAN'S ARRANGEMENT OF AIR VALVE-SETTING MECHANISM.

Brown & Sharpe's Catalogue.

The Brown & Sharpe Manufacturing Co., of Providence, R. I., have issued a catalogue illustrating a new line of universal milling machines, which embody many novel features, among which may be mentioned the method of clamping the overhanging arm, the table-tripping mechanism, the positively driven feed and the new method of indexing, by which all divisions from 1 to 360 can be obtained. Engravings and line cuts illustrate the reading matter. The catalogue is printed in paragraphs, with an index or "finding-word" in the margin, artistically printed in red ink. The pamphlet concludes with detailed specifications of these milling machines. Those who desire to obtain information about these new tools should apply to the company.

The New York Rapid Transit Tunnel.

The Rand Drill Co., of 128 Broadway, New York, have issued an illustrated pamphlet showing the uses and application of their drills and air compressors in the work of driving the rapid transit tunnel in New York city. The publication is not only concerned with the various kinds of work done by the Rand machines, here shown in a series of excellent half-tones with descriptive letterpress, but it deals with facts and figures of population, growth, early history of rapid transit, and the needs for further development of the system of urban passenger traffic. A map and profile of the railway is given, together with a description of the general construction of the subway. The geology of Manhattan Island is taken up and a map showing various sections of rock formations through which the tunnel passes, is presented. Drift, limestone and gneiss form the prevailing constituents of the south, middle and north portions of the island. Altogether the Rand Drill Co. have prepared a work, which will be perused alike by professional and lay readers with interest and profit.

The coke oven blowers in the Buffalo plant of the Lackawanna Iron & Steel Co. are to be operated by direct-connected electric motors. Ten induction motors of 75 h.p. each have recently been supplied by Westinghouse Elec. & Mfg. Co.

Tandem Compound for the Erie.

The Erie Railroad has received from the Cooke plant of the American Locomotive Company some tandem compound consolidation engines. These machines weigh 209,000 pounds in working order, of which 185,500 pounds is on the driving wheels. The cylinders are 16 and 30 in., by 30 in. stroke, and the tractive force is 45,900 pounds. The cab is centrally placed, or, in the language of the road, the engine has a "Mother Hubbard" cab, and this disposition leaves the fireman protected by the regulation steel hood at the rear.

The firebox has two circular fire doors, in the straight up and down back sheet. The injectors are both on the right side and just above, and between the two top checks a washout plug is placed, so that the portion of the boiler below the checks, where a deposition of sediment usually forms, can be easily washed out. The main reservoir is placed over the firebox, between the cab and the fireman's steel hood, where it is certainly out of the way. The engine is liberally supplied with hand rails, which the occupants of the cab will no doubt appreciate. In fact, the front part of the running board has a guard hand rail running along the outside, and in a way reminds one of the "good old days" when the running boards and front foot plate were all fenced in with a neat railing. On this engine, however, and in the busy present time, the fireman does not have to go out along the running board tallow pot in hand, as in those days referred to as "good."

The connection which supplies steam to the "fountain" in the cab, comes from the dome, and is placed as high up as possible in it, so as to insure the use of dry steam for the various mountings in the cab. All the driving wheels are flanged and the front pair are equalized with springs above each box. The back wheels, main driver and trailer, are also equalized with one semi-elliptic spring between them, the outer hangers terminating in coil springs.

The tandem cylinders have between them a floating sleeve carrying the piston-rod packing. As this rod and packing seldom sees the light, the self-adjusting feature provided by the floating sleeve allows for wear, and, indeed, provides for slight unequality in any direction. The valve is of course of the piston type and is driven by indirect connection in the usual way.

What one may call a safety feature is the providing of engineer and fireman each with a set of gauge cocks. The lower gauge is so placed that when it "runs water" the crown sheet is covered to a depth of 4 ins. This sheet is horizontal when the engine is standing level. The double set of gauge cocks gives two men a chance to watch the water level, instead of one, as is in line with the wise policy of having responsibility divided on important matters connected with locomotive management, just as responsibility for the observance of train dispatchers' orders is shared equally, when both men know what they are expected to do.

A few of the leading dimensions are as follows:

Fuel, fine anthracite coal.
Cylinders, 16 and 30 x 30 in. stroke.
Weight on drivers....................... 185,500 lbs.
Weight on trucks....................... 23,500 lbs.
Total weight of engine in working order.......................... 209,000 lbs.
Loaded weight of tender, 120,000 lbs.
Driving wheel base, 15 ft. 6 in.
Total wheel base of engine, 24 ft. 3 ins.
Wheel base of engine and tender, 51 ft. 11 in.
Driving wheels, dia. outside of tire, 56 in.
Driving wheel centers, material, main, cast steel; 1st, 2d and 4th, cast iron.
Engine truck wheels, dia., 30 in.; kind, "Standard"—cast iron center, steel tired.
Driving axle journals, dia., main, 10 in.; others, 9 in.; length, main, 12 in.; others, 12 in.
Engine truck axle journals, dia., 6 x 10 in.

BOILER.

Straight top, wide elevated firebox, rad. stayed.
Working pressure, 220 lbs.; horizontal seams, sextuple riveted.
Dia., first course, outside, 70½ in.; thickness of shell, $\frac{9}{16}$ to ¾ in.
Firebox, length, 114⅛ in.; width, 96¼ in.
Tubes, number, 369; dia., 2 in.; length, 14 ft. 6 in.
Heating surface tubes.................. 2,784 ft.
Firebox.................................. 199 ft.
Total.................................... 2,983 ft.
Grate surface, 76.27 sq. ft.
Slide valve, piston type; travel, 6 in.
Lap of valve, high and low; outside lap, ⅞ in.; inside lap, high, line and line, low, ¼ in. clearance.
Center of boiler from rail, 9 ft. 5 in; top of stack from rail, 15 ft. 6¼ in.
Brake, Westinghouse-American.

TANDEM COMPOUND CONSOLIDATION—ERIE RAILROAD.

TENDER.

Frame, 12 in. steel channels.
Truck, style, Barber. Wheels, cast iron; dia., 33 in.
Tank, water capacity, 6,000 gals.; coal capacity 10 tons.

The Man Behind the Throttle and the Man Behind the Gun.

The Johannesburg, South Africa, *Star* of July 1, in speaking of the Imperial Military Railway service, says: "To the whole railway staff, both the army and the civil population of these colonies owe no small debt of gratitude. Where all have done so well it may seem invidious to discriminate, but there is one body of men in particular to whom no one will grudge a special word of acknowledgment, the engine drivers who so freely and heroically risked their lives and for 18 months faced dangers in the performance of their daily task, compared with which the dangers of battle call for little fortitude."

Appointments at Purdue University.

The following additional appointments to the faculty at Purdue have recently been made: Mr. J. R. McColl, to be Associate Professor in Thermodynamics; and Mr. Fritz B. Ernst, to be Instructor in Car and Locomotive Design.

Professor McColl is a graduate of the department of Mechanical Engineering, Michigan Agricultural College, and has done work as a graduate-student both in that institution and at Cornell University. After serving for a time as an assistant he was in 1892 placed in charge of the department of Mechanical Engineering of the University of Tennessee at Knoxville, and for ten years has devoted himself to its development.

Mr. Ernst is a graduate of the department of Civil Engineering of Purdue University, and since graduating has been a member of the editorial staff of the *Railway Age*, of Chicago, in which position he has had much to do with certain phases of railway design.

Axle Light.

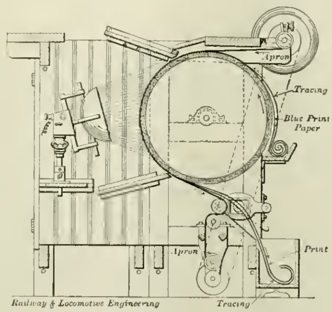
The Consolidated Railway Electric Lighting and Equipment Co., of 100 Broadway, New York, has contracted with the Chicago, Rock Island and Pacific, to equip with its "Axle Light" system of electric lights and fans all the cars now being constructed by the Pullman Company to be used in the new limited trains that go into service in November, between Chicago and San Francisco, via the Rock Island and Southern Pacific. This is the same "Axle Light" system of electric car lighting that is now in use on the twenty-hour trains of the New York Central and Lake Shore and Pennsylvania Limited, and also on the finest trains of the Atchison, the Grand Trunk; Chicago, Great Western; Missouri Pacific and St. Louis and San Francisco, and on the dining cars of other leading railway lines; also on all private Pullman cars, and on nearly all the official cars of railway presidents and general managers.

Injector's Action Explained.

The most convincing proof that there was nothing paradoxical in the action of the injector was given by Bourdon. This proof is of a purely experimental character, and is as follows: An air gun connected to a compressed-air reservoir has the open end of its barrel just opposite a valve opening inward in the said compressed-air reservoir. When the trigger is released, a bullet in the gun barrel will easily force the valve open and penetrate inside the reservoir. It is merely by momentum or *vis viva* acquired that the bullet overcomes the pressure in the reservoir. The same action takes place in the injector.

Blue Prints Made by Electric Light.

The making of blue prints by electric light has been carried to the point where plate glass disappears from the apparatus used. The machine consists of a large wooden cylinder, which is made to revolve slowly in front of the lamp, and any good photo-engraver's lamp will do. A transparent traveling apron moves with the drum. The apron is reeled up on small drum at the bottom of the machine and this and the upper roller upon which it is wound keep it in tension sufficient to always hold the tracing and printing paper close together, and against the large drum. The tracing and sensitized paper are fed in under the moving transparent apron at the top and both are received in a box placed below the large drum. The driving mechanism can be operated by belt from shop shafting or run by a small electric motor. The whole apparatus may be arranged so as to receive sunlight upon fine days by being mounted upon a truck. It has the advantage that it does not take up much space. The Spalding Print Paper Company, of Boston, are the makers of this apparatus.



BLUE PRINT APPARATUS.

The Lima Locomotive and Machine Works.

The new plant of the Lima Locomotive and Machine Company is now under construction at Lima, Ohio. The plant is located on 15 acres of ground, having connection with 3 railway systems, which give unexcelled shipping facilities. The buildings are all in accordance with plans furnished by the Osborn Engineering Company, Cleveland, O., who also superintend their erection. The structures are connected with a conveniently arranged system of railroad tracks, on which one of the company's Shay locomotives delivers material from one department to another. The entire plant has a complete sewerage, fuel gas and water systems, and the different buildings are heated by hot air, delivered by a blower system, furnished by the New York Blower Co. The entire plant is well lighted by electricity.

MACHINE SHOP AND ERECTING ROOM.

This is of steel construction, 120 x 200 ft., with side and end walls of brick; the whole covered by a tile roof. The middle span of the building is 60 ft. wide and 38 ft. from the floor line to the top of the crane track. On each side there are 2-story bays, 30 ft. wide, on which floors are machine tools. The middle span will be used for erecting purposes, having 4 tracks running the full length of the shop, of sufficient capacity to hold 20 locomotives at one time while in the process of erection. This erecting floor will be served by 2 electric cranes of sufficient capacity to handle the largest size locomotives. There is a cement floor on the ground and a slow-burning floor on the second story of the side bays, making the entire structure as nearly fireproof as possible.

The casting storage building is a frame structure, 93 x 100 ft., where gray iron and steel castings are stored and classified, so that a large stock can be kept on hand at all times. This building has several cranes, with railroad tracks which run inside, so that material can be handled quickly and economically. The blacksmith shop is of brick, with slate roof. It is well equipped with all modern oil and gas furnaces and the latest design forges, steam hammers, forging machines, etc. The frame and truck room building, 74 x 125 ft., is also used as a truck and frame shop, and is connected with the blacksmith shop. It is well equipped with wheel borers, axle lathes, wheel presses, arch bar drills, punches, cutoff saws, etc. The power house is a substantial 40 x 117 ft. fireproof building of brick construction, tile roof and cement floors. The boilers are of the internally fired design, with Morrison corrugated furnaces and are of 20-H. P. units. The engine is of 450-H. P. capacity, which furnishes power for 2 100-K. W. generators, manufactured by the Sprague Electric Co., which furnish electric power for lighting the buildings and operating the various motors attached to line shafting in the different buildings, and also serves a number of individual machines throughout the plant. The air compressor, blowing engine for the steel foundry and hydraulic plant for operating the flanging presses and riveting machines in the boiler shop are also located in this building. We next come to the mill, which is built of brick and has a slate roof. It is used as a planing mill and woodworking department, and is fully equipped with all the necessary machines. It is equipped with a shaving exhaust system.

BOILER SHOP BUILDING.

This is of steel frame construction, 120 x 140 ft., with brick sides and tile roof. The center span is 60 ft. wide and the 2 side spans each 30 ft. wide. The

erecting tower is in one end and equipped with hydraulic riveter of the latest design. A 15-ton electric crane travels the whole distance of the center bays, while several smaller traveling cranes operate in the side bays. All of the large tools, such as bending rolls, punches, etc., are driven by motors attached direct to the tools. The smaller ones are driven by a belt from the line shaft, which is also driven by a motor. The hydraulic power operating flanging presses, etc., is piped from the accumulator in the power house. The brass foundry is of brick, with slate roof, and has ample capacity to furnish all brass castings required. The new pattern storage is of brick construction, with tile roof, supported by steel trusses. There are no outside windows, the light inside coming wholly from skylights in the roof, the building being fireproof.

GRAY IRON FOUNDRY BUILDING.

This building will be of steel-frame construction, with brick side walls and tile roof; the center span 60 ft. wide and the two side spans each 30 ft. wide. An electric traveling crane will serve the center span the entire length of the building, while smaller traveling cranes will operate in the side bays. The cupolas and converters for steel castings are on the sides well toward the middle of the building, while the core ovens, drying ovens and annealing furnaces are in the same bay. The middle span and opposite bay will be used as molding and pouring floors.

When finished this will make one of the most complete locomotive plants in the country, and one that can be expanded to treble its capacity, as each building is so arranged that it can be largely extended without conflicting with its neighbor, and the machinery is also arranged with this end in view. The company manufactures Shay geared locomotives from 10 to 140 tons weight; also small direct locomotives of several classes up to 45 tons weight, and will have a capacity of 1 locomotive per day as soon as this new plant is in operation.

New Steel Car Float.

The keel has been laid for the second of the big steel car floats that the Fore River Ship and Engine Company is building at its yards on Quincy Point, Boston Harbor, for the New York, New Haven and Hartford Railroad and the first frames are already up. The other float is now well under way. These barges are of unusual size, each having three tracks with room on them for setting 23, 50-ton cars at one time. Steel construction was adopted in preference to wood because of the protection against accident which it affords and because its greater stability works a considerable saving in ordinary repair expenses.

Bridge Over the Strait of Canso.

Engineers say that a tunnel under the Strait of Canso, between Nova Scotia and Cape Breton Island, would be impracticable, and an ambitious bridge over the stormy waters is projected. The cost is expected to approach $5,000,000. Bridges over our East river in New York are vastly more expensive, but no great outlay for approaches will be required in Cape Breton. It may be predicted safely that the problem of dealing with huge masses of pushing, jostling people at either end of the Nova Scotia structure will not overwhelm the local authorities for many a generation.

New Book.

Foreign Trade Requirements. 1902. New York: Lewis, Scribner & Company, 125 East 23d street.

This book covers the export field and is designed to answer the questions constantly arising in connection with the conduct of foreign business. It has been carefully classified, condensed and arranged in the following sections:

Trade Conditions of the World; Traveling Salesmen; Agencies and Advertising; Credit Customs of the World; Commercial Laws of the World; Trade-Mark and Patent Laws of the World; Transportation Facilities of the World; Encyclopedia of all Principal Commercial Cities, Coins and Currencies of the World; Postal Regulations; Cable Rates; and Weights and Measures of the World, with United States equivalents.

The section on Trade Conditions gives a résumé of the commercial situation in each country with especial attention to the prospects for the ensuing year, in each important line of commerce, and to the most favorable openings for the extension of American trade. The material for this section has been collected by resident and traveling correspondents in the important trade centers of each country and the statistical information has been drawn from the latest figures of the various governments.

Of the book as a whole it may be said that a vast amount of time, labor and careful investigation has entered into its compilation. This volume, with the supplements that will follow it, is an earnest attempt to assist the manufacturer and exporter in their conquest of foreign markets and to present in condensed form the information that will be of benefit and use to all those who are interested in the development of foreign trade.

New and Old Books.

Some time ago a very popular work entitled "Burning Soft Coal Without Smoke" went out of print. The newer work on "Firing Locomotives," by Angus Sinclair, now takes its place. The price of the latter is 50c.

Motor-Driven Tools.

This is bulletin No. 24, issued by the Crocker-Wheeler Company, of Ampere, N. J. It is well printed and is bound in a reddish-brown cover made of a material resembling burlap, upon which is a shaft in section of black paper, to which is keyed a sleeve in bright red, the whole giving to the catalogue a striking and attractive appearance. There is no lengthy descriptive matter or tables in this pamphlet, the information is given by a number of clear, definite half-tones showing the applications of the electric motor which have been made for the distribution of power. Upwards of 40 machines of different kinds are shown, all with individual drives. The company invite correspondence, and will send the catalogue to those who write for it.

Steam Railway to be Operated by Electrical Machinery.

The last of the main generators and engines intended to be installed in the power plant of the Mersey Tunnel Railway, at Liverpool, are about to be shipped from the Westinghouse works at East Pittsburgh. These generators are of the railway type and are to be direct connected to vertical cross-compound Westinghouse Corliss engines of 1,500 h.p. each. The power generating plant will have an aggregate output of about 6,600 h.p.—6,000 h.p. for the railway proper, and 600 h.p. for lighting. The cars will be equipped with Westinghouse high-speed air brakes. The rolling stock will consist of 60 cars, each about 60 ft. in length. The trains will be formed of five cars each, the first and last cars of a train being motor cars equipped with four 100-h.p. motors each.

The Mersey Railway connects Liverpool and Birkenhead and passes under the river Mersey. The tunnel is double tracked. The route of the railway is about four miles and a half long. Its situation is unique, joining two such important business cities between which the only competition in the transportation of passengers and freight is given by ferry boats on the river, and the traffic on the line is large. The number of passengers carried amounts to between seven and eight millions per year with the steam locomotive system.

The railway is standard gauge, laid in accordance with heavy steam railway practice, the rails being of the ordinary English "Bull-head" type weighing 86 lbs. per yard. The line is to be fitted with the third-rail system, the conductor rail to be laid alongside and just outside of the running track. The running rails will not be used as the return electrical conductor, but a fourth rail is to be placed between them solely for this purpose. This will entirely prevent any destruction of the track rails or buried pipes in the vicinity, by electrolytic action. The third and fourth rails will be similar in size and in arrangement. They are to be of T-section, 60 ft. in length and to weigh 100 lbs. per yard. They will be effectively bonded and carried on stoneware insulators spaced at intervals of 7 or 8 feet.

It is expected that the trains will run on a three-minute service. The tunnel and the seven stations of the system are to be electrically lighted throughout. The power generating station, the machinery and the track work are all being pushed rapidly to completion.

Capital as Stored Force.

Capital is stored force, and as such falls under substantially the same laws as other stored forces. Great aggregations of capital may easily be the menace of society. They make it possible for the unscrupulously strong to conquer or crush the timid weak; they make it possible for vast organizations, it is not of the slightest consequence whether we call them corporations, combines, trusts, or corners, to cite fictitious values on the one hand, and to destroy those that are real on the other. They make it possible to produce a fictitious scarceness of the necessaries of life where there is none, and practically to annihilate values when weaker men refuse to yield to their decrees.

American Steel & Wire Co.

The American Steel & Wire Company, of Chicago, New York, Denver, San Francisco and Worcester, have published a catalogue containing the dimensions and weights of pure copper wire, the capacity of conductors, weights and lengths of iron and steel and many other tables useful to those who have to do with wire, cables, conductors, etc. A very useful page is No. 17, which is devoted to the statement of eight rules for the safe handling of light, power, and line wires. Now that electricity plays such an important part in railroad and industrial operations, information of this kind is of great importance, not only to the electrician, but to the layman as well. The catalogue will be forwarded to any one interested enough to apply for it.

Removing Boiler Scale with Petroleum.

For several years petroleum has been used extensively in Germany to remove scale from steam boilers. The oil was introduced with the feed water. When the water was drawn from the boilers, the oil, floating on top, would be deposited on the scale and dissolve it. There was no thought of danger in connection with the operation, but in a recent report issued by the government, attention is called to several accidents that have resulted from this method of boiler cleaning.—Ex.

Extra Heavy Driving Wheel Lathe.

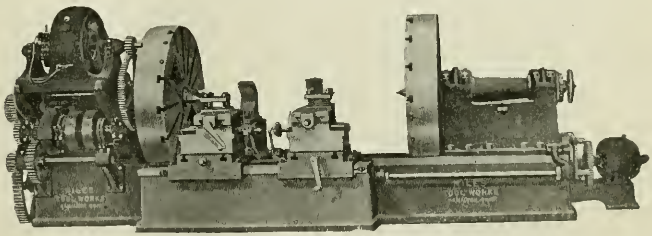
A driving wheel lathe weighing about 80,000 lbs. has been built at the Niles Tool Works, Hamilton, Ohio, for the Altoona shops of the Pennsylvania. This machine was designed to take very heavy cuts in turning tires on the tread on driving wheels ranging from 52 to 68 in. dia. The present standard high-grade, self-hardening tool steel is used. The power is supplied, as will be seen in the illustration, by a variable-speed motor of 25 h.p., the range of speeds being from 600 to 840 revolutions per minute. The motor connects to the gear train by means of a magnetic clutch, suitable change gears being provided in addition to the range of speeds in the motor to give a cutting speed of from 10 to 30 ft. per minute.

The magnetic clutch is double-ended and is so geared to the motor that when driving through one end the tire is turned at the speed given above. To cut out hard spots in the tire, the other end of magnetic clutch can immediately be brought into action, reducing the cutting speed to 4 or 6 in. per minute. The change from the ordinary speed to the extremely slow speed is instantaneous and is performed by throwing a switch. For adjusting the right-hand headstock a 3-h.p. motor is mounted at the end of the bed. The face plates are 72 ins. in dia. and fitted with internal cut gears, made of gun-iron. The former are provided with openings to receive the crank-pins, so that the wheels may be placed close to the face plates.

All of the shafts from the motor to the face plates run in bronze bearings. All of the large gears are of strong gun-iron and the pinions, of steel forgings. All of the gearing and shafts are designed to safely transmit a pressure of 18,000 lbs. to each tool.

The cariages and tool rests are massive in construction, the rests being provided with lateral adjustment on the carriages, as well as with swivel movement, to turn the necessary taper on the thread. The feed to the tool rest is by ratchet, driven positively from one of the driving shafts. By a suitable modification of the carriages an arrangement for turning journals can also be applied.

Quartering attachment can be applied to both heads if desired. The two quartering attachments, however, can work simultaneously only on pairs of wheels having left-hand lead. The smallest radius to which the quartering attachment can be worked in this lathe is 13 in. Modifications can be made, however, to permit of working smaller radius.



EXTRA HEAVY DRIVING WHEEL LATHE—NILES WORKS.

We understand that the Eastern Texas R. R. have ordered a combination passenger and baggage car to be rebuilt by the Hicks Locomotive & Car Works, of Chicago. Mr. F. M. Hicks recently sold a logging engine to the D. S. Pate Lumber Company. The engine had been rebuilt at the works. The St. Louis & Gulf Ry. have ordered a 50-ton mogul engine, cylinders 19 x 24, to be rebuilt at the Hicks Locomotive Works. Mr. Chas. B. Goes has purchased from F. M. Hicks a theatrical car, rebuilt at the works. The St. Louis & Gulf Ry. have placed an order calling for 40 flat cars to be rebuilt. The Empire Steel & Iron Company, Catasauqua, Pa., have purchased a four-wheel switch-engine from this concern; it was rebuilt by Mr. Hicks before the sale. The Colorado & Southern Ry. has ordered three baggage cars to be rebuilt at the Hicks Locomotive & Car Works. These are in addition to the previous order for passenger equipment, and the El Paso & South Western R. R. is having a private car rebuilt at the Hicks Works.

Growing Timber for Ties.

The Boston and Albany Railraod has set out 10,000 catalpa trees near Westfield, Mass., as the beginning of a plant for the production of timber for railroad ties. These trees, it is said, grow very rapidly in the West, and are ready for use in about sixteen years. The wood is straight-grained and of a quality very desirable for railroad ties. There is some uncertainty as to whether the catalpa tree will grow as well in the eastern climate as in the western and southern states.

Not in the Standard Code.

Every one has heard of the Irish railway on which a large sign was erected at one narrow part of the line, to the effect that "When two trains meet here, they must come to a standstill until they have passed each other."

Philadelphia Pneumatic Tool Co.

The Philadelphia Pneumatic Tool Co. reports an unprecedented rush of business and its manufacturing capacity is taxed to the utmost; running night and day to keep up with orders. The increasing demand for the Keller Rotary Drill is a particularly noticeable feature in this company's business. Four of the large Eastern steel companies have recently purchased Keller Tools to the aggregate number of 237. One of the Western trunk line railroads has recently made a contract with the Philadelphia Pneumatic Tool Co. to purchase at least 1,500 Keller tools within the next eight months. A cable order for Keller tools was received last week from Bilbao, amounting to several thousand dollars.

In consequence of this it is stated that the company will increase their capital stock to $2,000,000 in order to adequately deal with its rapidly growing business and to prosecute extensions of it into all parts of the world. Negotiations have been progressing for some time for the transfer of the European patents now owned by the Philadelphia Pneumatic Tool Co. to a syndicate composed of men prominent in shipbuilding and railway interests in England and Germany. It is proposed to form a European company with about $1,000,000 capital to manufacture the Keller pneumatic tools for the European trade. Mr. J. W. Tierney, president of the Philadelphia Co., will shortly sail for Europe to conclude these arrangements.

Draw Gear Tests.

The draw gear tests seem to have brought out much useful information. In fact, those tests are probably considered of greater importance than any conducted since the air-brake trials and vertical plane coupler tests. Again we find one manufacturer watching the other and accusing each other of submitting for trials draw gears which have been specially prepared to meet and pass the conditions of the tests, rather than supplying a device that will give superior service results. However, such keen scrutiny and rivalry will again redound to the advantage of the railroad companies, and especially so, if one feels that he must protect himself and his device by watching the other.

A little pamphlet on "New Tools" has been received. It is a supplement to Catalogue No. 16, of the fine mechanical tools manufactured by the L. S. Starrett Company, of Athol, Mass. Among the tools made may be mentioned, mercury plumb bobs, steel tapes, pocket rules, screw pitch gauges, spacing center punches, micrometers, etc., etc. Prices are given in each case, with sizes and description sufficient for ordering. The pamphlet will be sent to any address.

Atchison's New Wage Agreement.

A press dispatch says, on August 1 the new agreement concerning wages between the Atchison, Topeka & Santa Fe Railroad and the Brotherhood of Railway Car Men went into effect. Under the terms decided upon, the change will be gradual and will not be extended over the entire system until about January 1. Certain cases, where the need is most pressing, will be given advantage of the raise first. The increase will affect about 7,000 men and amounts to an average of from 10 to 12½ per cent. The agreement also provides for a 10-hour day and a possible hour off on Saturday.

The Rogers and Hubbard Company, of Middletown, Conn., appear to fully agree with Solomon that "a good name is rather to be chosen than riches." We judge this to be the case because in looking over the little pamphlet which they have just issued entitled, "Twenty Years Ago," we find that about that length of time back they placed upon the market an excellent granulated raw bone case hardening, without knowing the value of the word "granulated" as a name, and it was imitated. In order to get the real thing now they say it is necessary to order Hubbard's Black Diamond Granulated Raw Bone. Their pamphlet on "How to Case Harden with Granulated Raw Bone" is sent free to any address.

A paragraph in the newspapers says that the general passenger agent of the Pennsylvania Railroad has authorized the statement that through passengers on the new twenty-hour limited express between New York and Chicago will get a rebate on their fares if the train is late. The fare by this train is eight dollars more than the standard fare. If the train is two hours late the passenger gets two dollars back; if three hours late, three dollars, and so on up to four dollars.

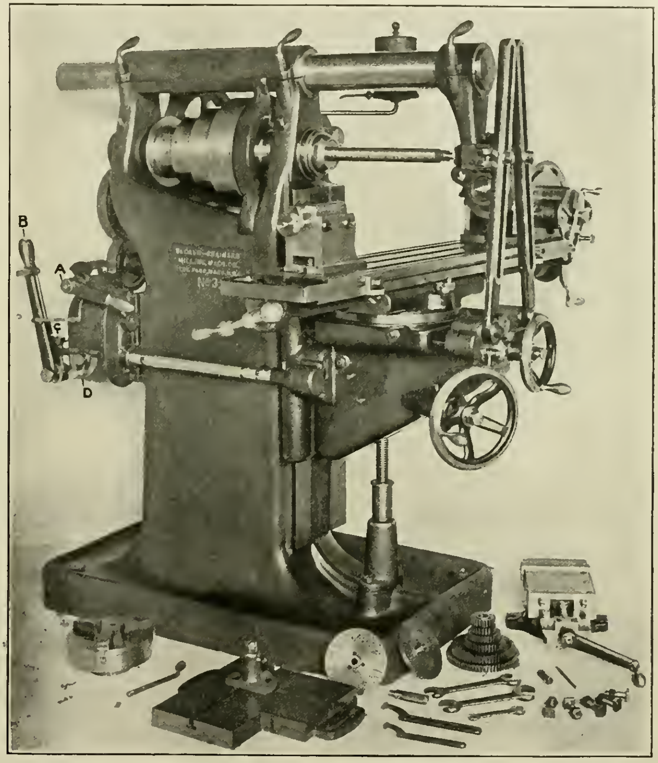
The catalogue of the National Car Coupler Company shows the National coupler by line cuts and in perspective in half-tone. The latter is intended to assist in recognizing the parts when ordering. The National steel platform and buffer is shown in plan and in perspective. This is followed by a complete order sheet in which all parts are outlined and numbered. The Hinson draw-gear single-spring pocket and the Hinson gear with tandem springs with friction buffer are shown in outline and explained. The catalogue is full of information, clearly illustrated and easy to order from. The company's works are situated in Converse, Ind., and the office is in the Monadnock Block, Chicago. Catalogues forwarded on application.

New Model Universal Milling Machines.

The Becker-Brainard Milling Machine Co., of Hyde Park, Mass., have placed upon the market a new line of plain and universal milling machines from new designs and patterns. These machines embody many new features, and in the design special attention has been given to strength, power, and rigidity in order to meet the demands of modern milling machine practice.

In the universal machines, the spindle is connected with the change-feed mechanism by a train of three spur gears, thereby eliminating the usual feed pulleys and are conveniently placed on the side of the feed box, and all changes may be made by the operator without stopping the machine or altering his position. The changes are made by the simple movement of the levers by bringing them into the position indicated on the index plate, which has each feed plainly marked on its surface, showing the exact position to which the levers must be brought in order to give some desired feed per revolution of the spindle.

Power is transmitted from the change-feed mechanism through the telescopic shaft connecting, by gears, the longitudinal, transverse, and vertical feeds, which are reversed by a lever on the side of the knee within easy reach of the operator. Both transverse and vertical feeds are operated and controlled by a lever located on the side of the knee, which, when central, disconnects both feeds and when thrown into position for one feed it is impossible to connect the other. Another important feature is a clutch arrangement enclosed in the hubs of the hand wheels which operate the vertical movement of the knee and cross movement of the carriage. When either the knee or carriage have been set to the re-



BECKER-BRAINARD MILLING MACHINE.

belt, thus giving the positive gear drive necessary for heavy and rapid cuts. The change-feed mechanism is a novel feature and obviates loss of time in changing gears. The feed is obtained and the feed mechanism is driven by the main spindle through a train of three spur gears on the back of the machine which drive two nests of change-feed gears in the column. By compounding the gears in the upper nest, various changes of feed are secured, giving, with the quick change in the gear case on the outside of the machine, 20 changes of feed for each spindle speed. Levers, operating the change-feed mechanism,

quired position, the clutch may be instantly disengaged by pressing in the knob on the front of the hand wheel, thereby preventing any accidental change from their fixed position, and also preventing the hand wheels from revolving when the automatic feeds are thrown in. The knee, which is of box type, provided with a telescopic elevating screw, makes holes in the floor unnecessary and allows the machine to be placed, regardless of beams or foundations. The thrust of the screw is taken by ball bearings.

In designing these machines the greatest care has been taken to secure the highest efficiency, together with accuracy and simplicity. Nevertheless, the parts are so arranged that they are within easy reach of the operator and of sufficient strength to prevent breakage from undue strain. Metal distribution has been properly proportioned, the base being very solid, and capable of absorbing vibration. The arm is a straight steel bar, so that any of the regular attachments can be placed in position without the necessity of removing the arm.

If you take an india rubber band about two inches in diameter and stretch it over a package of papers about three inches square, the rubber holds the papers tightly. If left in this condition on a shelf for perhaps a year, the rubber will have "lost its stretch," and when taken off the papers will not spring back to its old size, or indeed spring back at all. Its elasticity has disappeared. Where has the stored energy gone?

The Union Switch & Signal Company, of Swissvale, Pa., have just issued Section No. 1 of their catalogue of interlocking and signaling devices. The catalogue is very neatly and tastefully printed, and is illustrated with excellent line cuts and half-tones. All parts of the various machines, and there are many of them, are described, shown and catalogued with price, so that ordering may be facilitated. The company say that so many changes and improvements have been made in signaling appliances since the last general catalogue was issued in 1894 that it has been found necessary to revise that edition almost entirely; and, in order to place the information before the public as quickly as possible, the revised catalogue and price list will be published in sections as rapidly as they can be prepared.

An Englishman who came to Canada some years ago was very much mystified by the way our northern cousins are in the habit of speaking of their great transcontinental railway. They invariably use the initials of the road to designate it. "I am going to take a trip over the Canadian Pacific," he said, "but before I do, will you please show me the 'Seepiar?' Is it a lake?"

Messrs. Gould & Eberhardt, of Newark, N. J., are sending to their friends a neat celluloid-backed desk blotter, of convenient size, with several sheets attached. The blotting paper is intended to take up ink, and the user is intended to absorb the idea that this firm makes gear and rack cutting machines, in 18 styles and sizes, drill presses in 8 sizes, and extension base shapers in 14 styles and sizes. Other high class tools are also made. Gould & Eberhardt will supply blotters or machine tools to those requiring them.

The newest railroad tie, made of Mora wood, comes from British Guiana. The Pennsylvania Railroad have taken the initiative, and have placed an order, it is said, for Mora wood sleepers to be used on their roads. Mora wood is a dark colored hardwood of great strength and durability, and is said to last 50 years. This is just five times as long as the average life of the ordinary oak tie.

Mr. Baxter D. Whitney, of Winchendon, Mass., announces that he has entered into a partnership with his son, Mr. William M. Whitney. The firm name therefore becomes Baxter D. Whitney & Son. In making the pleasing announcement, Mr. Whitney says: "The same business principles which have ruled from the founding of my plant over 60 years ago will remain in force." The firm makes woodworking machines. Circulars sent to any address on application.

The general manager of the Chicago and Northwestern railroad has reported to President Marvin Hughitt that the work of double-tracking the main line of that road as far as Ogden is completed. This will make an important improvement in the facilities of both the Northwestern and the Union Pacific for handling of transcontinental traffic.

Westinghouse, Kerr & Company announce the removal of their New York office from the Havemeyer Building, 26 Cortlandt St., to the Maritime Building, Nos. 8 and 10 Bridge St., opposite new Custom House and near Bowling Green. The change is the result of a largely increased business. Three floors, the first, second and third, will be devoted to their uses. The future official address will be, Westinghouse, Church, Kerr & Co., 8-10 Bridge St., New York city.

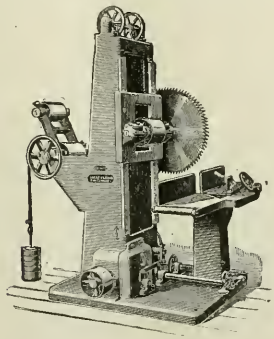
The tipping habit oversteps the limit when a man growls all through a meal at the inattention of the waiter, and then "turns to" and fees him as a reward for his abominable service. The tipping system should at least have the extenuating excuse of being reformatory, by making a fee dependent upon good service.—From "Vest Pocket Confidences," in *Four-Track News* for July.

New Cut-Off Saw and Gainer.

This cut represents a new and improved machine especially built for car shops, bridge and agricultural works and ship yards.

Special attention is invited to some of its features. It will carry a saw 40 inches in diameter, cut-off material 13 inches square, or 26 inches wide by one inch thick, and when proper gaining head is used, will cut a gain 6 inches wide and 1½ inches deep. The head expands from 3 to 6 inches. The column is securely bolted and has a large base, thus decreasing vibration.

The feed raising the arbor consists of frictions operating on two large screws resting on ball bearings, nuts being fitted to take up all wear. The arbor is easily adjusted, controlled by treadle convenient to operator, and the travel regulated by adjustable stops. The table is mounted on a stand, adjustable to and from the arbor, and can be swung to an angle of 30 degrees. It has friction rolls on each side, and provision is made for securely holding the work. The machine can be belted either over-head or from below, the swinging idler being reversible to bring the weight into action for either position.



CUT-OFF SAW AND GAINER.

Further particulars, cuts fully describing it and terms, will be sent willingly by the makers, J. A. Fay & Egan Co., of No. 445 West Front St., Cincinnati, Ohio, who will also send free their new 450-page catalogue showing all their machines, to those interested, who will write for same, mentioning RAILWAY AND LOCOMOTIVE ENGINEERING.

Mr. R. C. Fraser, for the past three years eastern sales agent of the Monarch Brake Beam Co., Limited, has been appointed manager of the railroad department of the U. S. Metal and Manufacturing Co., 25 Broad St., New York. This company is selling agent for the Johnson Hopper flush box car and refrigerator doors, the National Railway Specialty Co.'s adjustable bearing and wedge, the combination steel draft rigging and underframe, and railroad agents for the Cliff & Guibert automatic hose reel.

A Loving Cup.

A tribute of sincere affection and regard, in the shape of a sterling silver loving cup, tastefully inscribed and decorated, was recently presented to the Hon. John A. Walker, vice-president of the well-known Joseph Dixon Crucible Company, by the Dixon staff. The occasion of the presentation was the return of Mr. Walker from an English and Continental tour. An informal dinner at "the Arena" in New York, presided over by Mr. Harry Dailey, was where the presentation was made, and it is needless to say that all present greatly enjoyed honoring the guests of the evening. Letters and telegrams from "absent friends" were many and hearty. Mr. Walker has been with the company 35 years, and the evidence here given of the record he has made with all who come in official contact with him is one of which any man may feel justly proud.

The Buffalo Forge Company's catalogue of improved ventilators shows in engraving and section the construction of the device. The ventilator is so designed that any movement of outside air across the top of the ventilator causes an upward flow of air in the ventilator. It is storm and rain proof. The Buffalo fan system of heating and ventilating is also explained and illustrated.

The Blacksmiths Have Met.

The National Railroad Master Blacksmiths' Association met in annual convention at the Wellington Hotel, Chicago, August 19, 20 and 21, with a large attendance of members. President W. P. Savage was in the chair. Many able papers were presented by the committees and the discussions on these papers brought out much valuable information as to the most modern methods of handling work in the smith shop. Among the various papers presented may be mentioned those on the subjects of Flue Welding, Oil as Fuel, Track Tools, Best Form of Oil Furnace, The Reduction of the Art of Blacksmithing to an Exact Science. The following officers were elected for the ensuing year: President, John McNally, Chicago; first vice-president, George Lindsay, Evansville, Ind.; second vice-president, Thomas F. Keane, Hillburn, N. Y.; secretary and treasurer, A. L. Woodsworth, Lima, O.; chemist, G. H. Williams, Boston. The association will meet next year at Buffalo, N. Y.

The San Gabriel Electric Co., of Los Angeles, Cal., have recently purchased a 750-k.w., two-phase, engine-type Westinghouse generator which is to be installed in a sub-station of the Pacific Light & Power Co. The latter company have recently acquired the San Gabriel Co.

Traveling Engineers' Association.

The tenth annual convention of the Traveling Engineers' Association will be held at Chicago, Ill., commencing at 9 A. M., September 9, 1902. The Stratford Hotel, corner of Jackson and Michigan boulevards, has been selected as the headquarters. This hotel is on the European plan. Arrangements have been made with the Pullman company for a rate of one-half fare for members and their families to and from the convention. To obtain these rates, pay fare going and take receipt. Some time during the meeting, call upon Mr. C. R. Wager, Pullman Building, Chicago, district superintendent, present receipt together with membership certificate for 1902 or 1903, and pass will be issued for return trip. On and after August 15, 1902, the office of the secretary of the Traveling Engineers' Association will be No. 7 Manning square, Albany, N. Y.

Elbert Hubbard's Idea of Pay.

Every employee pays for superintendence and inspection. That is to say, a dollar-a-day man would receive $2 a day were it not for the fact that some one has to think for him, look after him, and supply the will that holds him to his task. Incompetence and disinclination require supervision, and they pay for it and no one else. The less you require looking after, the more able you are to stand alone and complete your tasks, the greater your reward. Then if you can do your own work and also intelligently direct the efforts of others, your reward is in exact ratio, and the more people you can direct the more valuable is your work.—*Graphite.*

The British government has arranged to send Col. H. A. Yorke to the United States in September for the purpose of investigating and reporting on our methods of operating railroads.

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XV. 174 Broadway, New York, October, 1902 No. 10

Fast Passenger Engine for the Chesapeake & Ohio.

In our August issue we illustrated a 4-6-2 type of engine for the Missouri Pacific Railway. We are now able to present an engine of similar wheel arrangement for heavy fast passenger traffic on the Chesapeake & Ohio Railway, built at the Schenectady plant of the American Locomotive Company, from designs by Mr. W. S. Morris, formerly superintendent of motive power on that road.

The 4-6-2 wheel arrangement is not new. An engine of this type was built by the Schenectady Locomotive Works for the Chicago, Milwaukee & St. Paul Railway, one of which was in service in December, 1895. In that engine the trailing truck was introduced to bring the weight on the drivers within the limits of the specification, the total load on them being 44 tons.

The engine now illustrated is simple, with 22 x 28-in. cylinders, 72-in. drivers and the weight on the drivers is 131,000 pounds. The tractive force developed is 32,000 pounds, with coefficient of adhesion 4.09. The valves are of the piston type, and the rocker hanging from a bracket on the yoke gives direct connection for the valve gear. The crosshead is of the 2-guide-bar type, and the piston rod is fastened to it with collar and nut.

The boiler is of the extension wagon top type, 66 in. in dia. at the first ring. The firebox is wide and the back sheet slopes forward 14½ in. to give more room in cab. The cab is made of steel, with front corners neatly rounded, but it is without the clearstory on top which many of the C. & O. engines have. The side windows are arranged so that the rear one has two sashes and is twice the size of the one in front, so that the engineer has plenty of light and lots of window room.

The engine is so proportioned that the wheels do not look as large as they really are. The center of the boiler is about 9 ft. above the rail, and the height to the top of the stack is 14 ft. 11 in. The engine is equipped with Westinghouse-American combined brakes, with high speed attachment on drivers, trailer, tender and for train, with 9½-in. air pump, and the main reservoir is carried on the back of the tank.

A few of the principal dimensions are given below:

GENERAL DIMENSIONS.

Fuel, bituminous coal.
Weight in working order, 187,000 lbs.
Weight on drivers, 131,000 lbs.
Wheel base, drivers, 12 ft. 8 in.
Wheel base, rigid, 12 ft 8 in.
Wheel, total, 32 ft. 8 in.

CYLINDERS.

Dia., 22 x 28 in.; piston rod, 3½ in. dia.

VALVES.

Valves, piston type, travel, 6 in.
Outside lap of slide valves. 1 in.
Inside clearance, ⅛ in.
Lead of valves in full gear, line and line.

WHEELS, ETC.

Dia. of driving wheels outside of tire, 72 in.
Driving box material, cast steel.
Dia. and length of driving journals, 9 in. dia. x 12.
Dia. and length of main crank pin, 7¼ x 4¾ in.
Main driv. pin, side rod, 7 x 6½ in.
Dia. and length of side rod pin, 5 x 4½ in.
Eng. truck journals, 6 in. x 12 in.

BOILER.

Style, extn. wagon top, wide fire box.
Outside dia. of first ring, 66 in.
Working pressure, 200 lbs.
Thickness of plates in barrel and outside of fire box, 11/16, ¾, ½, 23/32 in.

FIRE BOX.

Length, 90 in.; width, 75 in.
Plates, thickness, sides, ⅜ in.; back, ⅜ in.; crown ⅜ in.; tube sheet, ½ in.
Water space, front, 4 and 5 in.; sides, 3½ and 5½ in.; back, 3½ and 4½ in.
Crown staying, radial.

TUBES.

Charcoal iron, number of, 291; dia., 2¼ in.
Length over tube sheets, 19 ft. 6 in
Fire brick, supported on water tubes.

Heating surface, tubes	3328.28 sq. ft.
Heating surface water tubes........	23 sq. ft.
Heating surface, fire box	182 sq. ft.
Total............................	3533.28 sq ft.

Grate surface, 47.02 sq ft.
Smoke stack, inside dia., 18 in
Smoke stack, top above rail, 14 ft. 11 in.

TENDER.

Wheels, dia., 36 in.; journals, 5 in x 9 in.
Frame, 10 in. steel channels.
Trucks, Schenectady Works S't'd with C. & O. box and center plates.
Water, 6,000 U. S. gals.; coal, 8 tons.
Total wheel base of engine and tender, 60 ft. 0 in.

FAST PASSENGER ENGINE FOR CHESAPEAKE & OHIO RAILROAD.

The De Glehn Compound.

An interesting letter from Mr. A. G. de Glehn, written from France, on the merits of the four-cylinder compound with which his name is so closely connected appeared in a recent issue of the *American Engineer*. The inventor says that the compound which he introduced in his own country seems now in a fair way to be tried in Great Britain and the United States. In dealing with the objection generally made, that two sets of valve gears are an unnecessary complication he says in effect that for people wedded to two-cylinder engines, four cylinders become a "complication." A locomotive is a very hard worked machine, and all its parts can only have relatively small wearing surfaces, in proportion to the work done, principally for lack of room. Being limited in width, we are compelled to give to pins, axles, etc., greater diameter. By dividing the engine and the valve gears, we have doubled the number of parts, but have halved the work each part has to do, and owing to the location of the cylinders we have more room, as the H.P. cylinders drive one axle, and the L.P. cylinders, another. This dividing of the total work among a larger number of smaller and lighter parts, and thus being able to give them proportionately larger wearing surfaces, has had a marked effect on the wear of the parts, and a generally favorable result has been obtained. The halving of the work of crank axles has very largely increased their mileage. These facts explain why the cost of repairs has not increased with the number of parts.

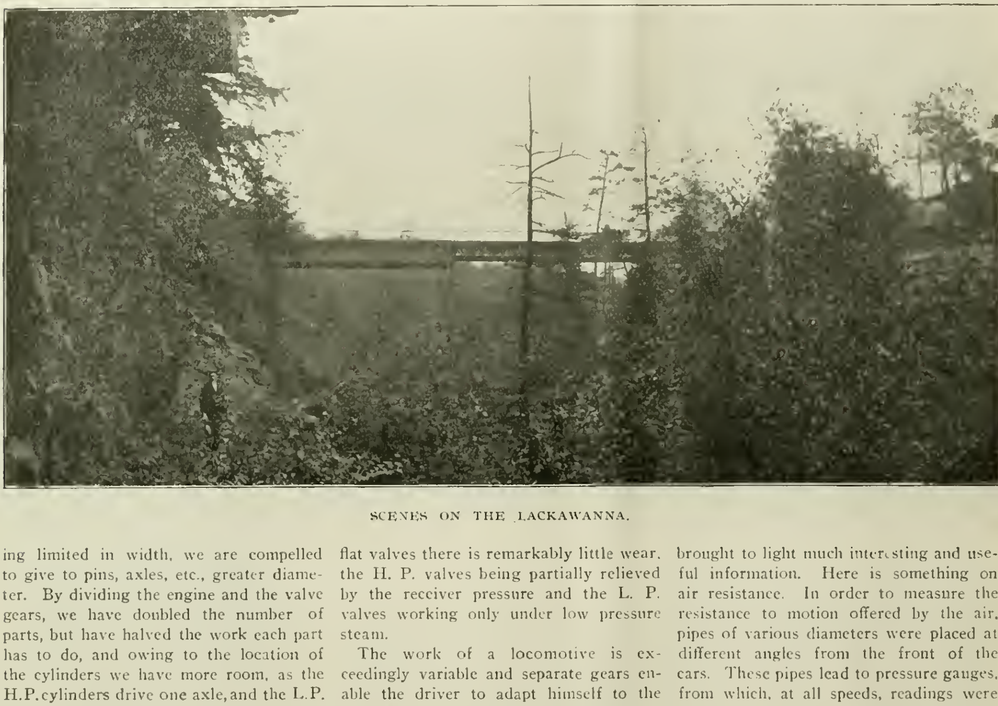
With high piston speeds it is of importance that steam should pass from the boiler to the exhaust in as direct a course as possible. M. de Glehn points to his four-cylinder engine with two sets of valve gears, as one which shows that this flow of steam is freer than in the case of a four-cylinder engine with one piston valve on each side to regulate the steam distribution of the two cylinders on that side. The gridiron openings in these valves and bushings interpose obstructions to the free steam flow. A single valve and casing distributing high and low pressure steam he considers as uneconomical. Piston valves are much more difficult to keep tight than flat valves, and they can not lift off their seats for the relief of cylinders as flat valves do. When not tight the leakage of steam constitutes a very serious loss. A really satisfactory piston valve may yet be found, but it is hardly in sight as yet. In four-cylinder compounds with separate gears and four flat valves there is remarkably little wear, the H. P. valves being partially relieved by the receiver pressure and the L. P. valves working only under low pressure steam.

The work of a locomotive is exceedingly variable and separate gears enable the driver to adapt himself to the varying conditions. The H. P. and L. P. cutoff can be regulated, so that if required an earlier cutoff may be had in the H. P. cylinder than that in the L. P. Coming to the intercepting valve, the inventor claims that an exceptionally rapid start can be made, as steam at reduced pressure can enter the L. P. cylinders at the same time that the H. P. are working normal, and so the engine has four cylinders working simple at the same time This valve enables a driver in case of accident to work the H. P. cylinders alone, or the L. P. alone, as the case may be.

M. de Glehn says his experience is that if one wants to get all there is out of an engine—maximum rapidity and certainty in starting, greatest power for a minimum of weight, maximum smoothness in running at high speeds, maximum adaptability to varying circumstances, to say nothing about perfect balancing—one can get these best by a four-cylinder compound with H. P. cylinders outside, placed about the middle of the engine and driving one axle, and the L. P. cylinders between the frames and the smoke box, and driving the crank axle, and with separate valve gears for high and low pressure cylinders, and an intercepting valve.

Air Resistance to Moving Trains.

The tests of speed made on the experimental Berlin-Zossen electric railway have brought to light much interesting and useful information. Here is something on air resistance. In order to measure the resistance to motion offered by the air, pipes of various diameters were placed at different angles from the front of the cars. These pipes lead to pressure gauges, from which, at all speeds, readings were taken. One pipe in particular was arranged so that it could be extended, or made to occupy various positions in front. The readings obtained from the gauge in connection with this pipe indicated that a uniform cone of more or less compressed air was pushed ahead of the car. At 32 miles per hour the pressure was about 2.7 pounds per square foot; at 37 m.p.h, 4.1 pounds; at 43 m.p.h., 5.0 pounds; at 50 m.p.h., 6.2 pounds; at 62 m.p.h., 10.4 pounds; at 75 m.p.h., 15 pounds; at 81 m.p.h., 17.5 pounds; at 93 m.p.h., 23 pounds, and at 96 m.p.h., 24.6 pounds. From these experiments it appears that



SCENES ON THE LACKAWANNA.

the accepted law that air resistance varies directly as the square of the velocity is correct, but that the coefficients of resistance have been too high. The formula $P = .0027\ V^2$ has been deduced from these tests.

Some Personal Recollections.

BY SHANDY MAGUIRE.

Part II—The Defense.

A few days after our oil debauch Larry Dale, the conductor, or "Old Larry" as he was familiarly called, got a note from the superintendent notifying himself and baggageman, engineer and fireman to be at his (the superintendent's) office at 10 A. M. of the following day. Rumors had been blown around by the tongues of talking machines that things were not right on the local. The Stove Pipe Committee existed then, as well as now. We—the engineer and myself—got after Larry, to get a pointer, if we could, so as to be ready when we got on to the "sweat cloth," in front of his high mightiness, the Super. You will note that what is now called going on "the carpet" was then the "sweat cloth." There have been leveling down in the official conceit since those days. They are much easier to approach now. Time was when we had to kow-tow to a general manager, wherever he existed, in the same manner a Chinaman has to approach a mandarin, and a superintendent had to be viewed through a piece of smoked glass, just the way we would try to get a glimpse of the sun.

Larry didn't know anything. He was one of the pillars of the most fashionable church we had in our city, and it broke him all up to think that any suspicion of wrong would be directed to his train. His baggageman was also an attendant of the same shrine of Christianity, and as fine a hypocrite as ever meandered around the sisters, with as unctious and sonorous an "amen, dear Lord" emanating from his lips, as the slickest of some railway Y. M. C. A. swaddlers whom I know of, going around to-day, and who might pass unnoticeable; but that in the making up of the annual committees, they persistently insist on being placed on the Divine Worship Committee.

The superintendent's clerk was dead on to the whole racket, I knew. I had a friendly acquaintance with him. He was one of those genuine good fellows, whose hand never felt flabby in one's grasp. He has since become distinguished in the railroad world, and prosperity hasn't turned his head. The same sized hat fits him to-day as the one did about forty years ago. God bless him and all his kind! May his tribe increase! I tipped the wink to Charlie—the clerk—that I would like an interview. He tumbled, with a smile, as much as to say "one!" We met behind the building. He said, "What's up?" That's what I want to find out, Charlie, old boy, and you must tell me. You know that we are all to go on the sweat cloth at ten o'clock, and we don't know for what.

"Whose been tapping the kegs on the local?"

"What kegs?"

"Say, now, be honest. Confess and I'll save you."

"I don't understand you."

"In about twenty minutes from now, you'll understand the old man."

"Has he any proof that any of us did anything wrong?"

"He believes that whoever has been tampering with the packages and kegs of first-class freight in the local cars, that it is neither old Larry nor the baggageman."

"Then the business simmers down to a suspicion of Tom and myself?"

"Less than that."

"Then I'm to be hanged?"

"It looks a little that way."

That was all I wished to know. I foresaw my doom. I saw Tom before going up stairs. He was as forlorn looking as if he had said a fistful of prayers over the grave of his mother-in-law. He merely looked at me. My countenance then, as now, was an open book.

"The jig is up," he said.

"What did you hear?" I asked.

"Nothing, but your looks will hang us two."

"I'll save your head from the halter. It's five minutes to ten. Let us brace up."

The cold formalities of official niggardliness were our portion as we entered the office of the lord of life and death. Old Larry sat looking like abysmal horrors of hopeless grief. His factotum sat beside him, with a smirking-didn't-care-a-fig sort of a smile directed at Tom and myself. The old man lost no time convening the court. We were left standing, Tom and I. A preliminary glance at Charlie by the super opened the ball.

"Are you men aware of what you've been doing right along on your train?"

No reply.

"Dale, can you explain why it is that you get first class freight at Syracuse for delivery to our patrons along our line and it seems to be tampered with before it is delivered to them here?"

SCENES ON THE LACKAWANNA.

"It never happened on my train, sir, to my knowledge, I can positively say."

"What have you got to say to that, Beckman?"

The factotum stood up and said: "I never leave my car, sir, since you told me to stay where I could watch the packages and the mail, so I cannot tell you anything, because I cannot say surely, or if I could I would."

"Sit down, Mr. Beckman, that will do."

"Bennett, what do you know about this?"

"Not a thing, sir," said Tom.

It was my turn now, and I got a breathing spell while he was delivering his introductory harangue, before ordering my head on to the block.

"For some time complaint has been coming to my office from shippers that their goods have been tampered with in transit. I have been keeping a close watch, hoping to catch the guilty party or parties employed in this nefarious work. I now have a clue that points so strongly to the guilt of one or more on the local; it will be established when this investigation is ended beyond peradventure. The chief source of complaint is the tampering with liquor kegs, and causing a shortage. Last Saturday, a barrel of machinery oil was found in car 2341 on its arrival, with a quill inserted in a small hole, and evident marks indicated by shavings on the head of the barrel, that a gimlet had been employed. This points to a very systematic method of tapping the kegs and barrels, and gives me a clew to the business. In the case of the barrel in question, in which the quill was found, it was marked 'old rye,' and nothing showed about it to tell that machinery oil was contained in it. Another thing which leads directly to the door of truth, and convinces me that I am on the right track, is a complaint from Mrs. Donovan, who lives on the borders of the 'Goose Pasture,' in Syracuse, where the empty cars are stored, that from a flock of forty-two geese she had this spring, sound in wind and limb, she now complains that mostly all of them have gone lame, or go 'hippidy hop,' as she calls it, caused by parties on the local stoning them, when they go over there to get empty cars, which is about daily. This leads me to unhesitatingly conclude that the geese are stoned, so as to temporarily disable them to obtain quills, to manipulate the kegs. Now," said he, looking directly at me, "you see I have sufficient evidence to act on the case, and I ask that this investigation be not one moment delayed by any equivocation. What do you know about this?" he sneered at me.

I saw by this time, and the smile of Charlie that my name was Dennis, and I thought I might as well be hanged for a sheep as a lamb, for when I heard of Mrs. Donovan and her lame geese coming into the court martial, I knew the result. I did not hesitate one second in my reply, and I answered "Not a darned thing."

"Do you mean to inform me, sir, that you did not on several occasions stone Mrs. Donovan's geese?"

"I mean to inform you, sir, that I could not hit a flock of barns, if within fifty feet of me flying."

"Do you know anything about who left the quill in the machinery oil barrel last Saturday?"

"I do not, and if I did I wouldn't tell you. This job of mine is 'neither a bargain nor a dead job,' and I don't propose to turn informer, provided I know the guilty ones, to throw in with my block-pitching and brass polishing for a dollar a day of sometimes twenty-seven hours. Laborers get a dollar and a half a day for ten hours now, and besides, bounties of eight hundred dollars are being paid to soldiers; so you had better give me the few hard-earned ducats I have coming, and I'll be off to the wars."

That was my last card. I played it with a face of bluff worthy of a nobler cause, and walked out of the office as independent as a conductor's wife airing a new hat, costing about thirty dollars, passing the humble home of her husband's poverty-stricken engineer.

The caller came after me that evening as usual. I heard no more of the hippidy hop business, except a shot Charlie fired at me as we were pulling out that same night. He said, "Let up on the goose question, if you take my advice." I did. Soon after I joined a temperance society, and I yet live up to its rules.

A Meter Gauge Locomotive.

A peculiar locomotive for service on the meter (39.37 in.) lines of the French Department of Railways has recently been built at the Swiss Locomotive Works at Winterthur. The grades are heavy and the curves are sharp, and consequently the necessary tractive force required the use of six coupled axles. The engine is a 12-wheel tank, four-cylinder compound, with cylinders about 12 and 19 x 21½ in., and the drivers are about 40 in. The leading three pairs of wheels are driven by two cylinders, in the usual position opposite the smoke box, while the rear three pairs of wheels are driven from cylinders placed about midway between smoke box and cab. Each three pairs are coupled, together, but the first three pairs are entirely independent of the rear three pairs. The cylinders in mid position are the high-pressure cylinders, and have short direct steam pipes from the dome. Steam exhausted from the high pressure cylinder passes into a long straight receiver (one for each side), from which it reaches the low pressure cylinders in front. The valves are ordinary slide valves, and the valve motion being all outside, the firebox is placed over the rear set of axles with close fitting ash pan between. The engine has been built on Mallet's system. It has its rigid wheel base divided into two sections, of six wheels each, so that the axle load is not greater than the light rails it runs on can bear, and the sharp curves can be taken with comparative ease. The locomotive is fitted with Hardy's vacuum brake, and also with an air compression brake for regulating the speed on grades. This air compression brake is on the same principle as those used on all Swiss mountain rack railways. Atmospheric air is allowed to enter the exhaust pipe through a valve which is operated from the footplate. The trials to which the first of these engines was subjected have resulted so satisfactorily that four others are being built. They are spoken of as 12-wheel coupled compound duplex tank locomotives, built on the Mallet system, and we believe their wheel arrangement would tax even the Whyte system of nomenclature to adequately express.

Ratio of Expansion.

To find the number of expansions of the steam in any engine, simple or compound, divide the final volume by the initial volume. This is approximately the same as the initial pressure divided by the terminal pressure where the pressures are expressed in pounds per square inch absolute. Then the number of expansions equals the volume of the low pressure cylinder divided by volume of high pressure cylinder to point of cut off. Supposing the volumes of the cylinders of a two-cylinder engine, compound, were as 1 to 4, and the steam being supplied to the high pressure cylinder through the whole stroke and then exhausted into the low pressure cylinder, the number of expansions would be final volume divided by initial volume, equals volume of low pressure cylinder divided by the volume of the high pressure cylinder=4. But in case the steam is cut off in the high pressure cylinder at one-third of the stroke the number of expansions would equal final volume divided by initial volume equals volume of low pressure cylinder divided by one-third the volume of the high pressure cylinder, which would be 4 divided by ⅓=12.—*Ex.*

The C. W. Hunt Company, of 45 Broadway, New York, has issued a neat little pamphlet setting forth the advantage of what are called Industrial Railways. This is the name given to narrow gauge or other railways which run through the grounds and shops of large manufacturing establishments at home and abroad. The Hunt Co. are prepared to supply electric locomotives, cars, tracks, etc., suitable for such a railway, or give information relative thereto. The works of the company are on Staten Island, N. Y., and a great variety of small railway machinery can be seen there. The pamphlet will be sent to any address.

Mountain Climbing in New Zealand.

This picture shows a train handled by three locomotives ascending a very steep grade on one of the New Zealand railways. The make-up of the train is interesting, the locomotives are not placed as a triple-header, but are distributed in the forward part of the train. The first engine is separated from the second by four cars, the second is separated by four from the third, and the third has six cars behind it. The view point chosen in taking the picture has been well selected.

Axle Grease as a Luxury.

Every one knows, of course, that Esquimaux like fat foods. Ninginik would not hesitate long in choosing between a pound of marshmallows and a box of delicious axle grease. It is necessary to feed the tiny people upon eggs, bread and vegetables in our warm climate, however, and Mr. Smith, who brought them from Labrador, has to maintain rigid diet rules. At Buffalo, he was in the habit of giving them bits of tallow candle at bedtime, but when he found that they ate them and went to bed in the dark, he provided a nice, fat incandescent light for the use of the whole village. His charges seldom get homesick, and their diet keeps them in excellent health. They are of a cheery disposition, and like America.—From "Our Polar Suburb," by James H. Collins, in *Four-Track News*, for September.

The Compound is Twenty-five Years Old.

The coming of age of the compound locomotive happened four years ago, and as this year is the twenty-fifth anniversary of the application of the compound principle to locomotives in France, the type may almost be said to have reached years of discretion, at least in ancient Gaul. The first compounds were designed by A. Mallet and were operated between Bayonne and Biarritz. They had one high and one low-pressure cylinder, and could be worked in simple or in compound. There are said to be about 15,000 compounds of all kinds in use in Europe at the present time, two-thirds of which are of the Mallet type. The growth of the compound in this country has been very much slower than abroad. The first notable compound here was Dunbar's engine, which had five cylinders, and which ran on the Boston & Albany in 1883. The Dunbar engine was not satisfactory and no further progress was made in the United States until 1888. In this and the following year, Webb's three-cylinder compound was tried on the Pennsylvania, the first Vauclain compound was built for the B. & O., and the first Schenectady compound with intercepting valve was operated.

Increased Longevity.

An increase in the longevity of the population is shown by the last census of the United States. A computation was made of the median line, which is the half-way station between birth and the average age reached by the people. According to the statisticians the median age of all whites in the American republic advanced from 18.3 years in 1890 to 23.4 years in 1900, and what is more the increase in the median age of Caucasians in the United States has, during nine decades, risen 7.4 years. There is no doubt that it is to the wide dissemination of the laws of hygiene and sanitation in civilized countries that the increased longevity is due.

AN ANTIPODEAN MOUNTAIN TRAIN MAKE-UP.

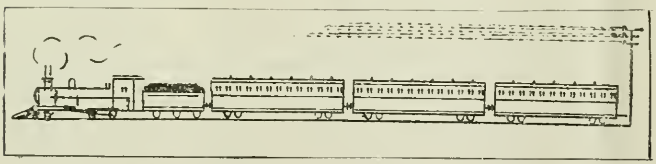
Blinks.—"Our friend Rails, who stutters, told me he had never traveled on a limited train in all his life."

Jinks.—"I suppose that's because he can't express himself."

A "Type" of South African Railway.

We present herewith an illustration of an engine and train from South Africa. The engine and cars appear to have been built at the Remington works. Most trains are drawn by an engine, but this one, we are informed, was drawn by a typewriter. Mr. E. G. Denning, of Cape Town, S. A., sends this clever little sketch to the *Strand Magazine*, of London. He says:

"I send you the sketch of an engine, tender and three coaches drawn by myself entirely with a Remington typewriter, not a stroke of any kind being added by hand. For those not familiar with the typewriter, I will explain that: the general outline is a continuation to various lengths of the '—' (dash) used in underlining, the different angles being produced by shifting the paper in the machine; the windows and buffers are inverted commas; the wheels and roof-lamps were formed by placing a strip of paper over the carriage body and striking 'O' and 'A' respectively in such a manner as to show only a portion of each letter in the drawing; the dome of the engine is an inverted 'U'; six brackets in different positions indicate steam; the somewhat excessive quantity of coal in the tender is a composition of 'dashes' and 'full stops'; and, lastly, the telegraph wires and posts are made of dots and dashes."



TYPEWRITER TRAIN FROM CAPE TOWN, SOUTH AFRICA.

Moving Pictures.

Any railroad man who has ever taken indicator diagrams on a locomotive, or has had a view of the permanent way, from the front footplate, when traveling at high speed will have in his memory a vivid recollection of all that he saw. He may, if he wishes it, have his experience duplicated, in part, as he sits comfortably in the orchestra chairs or gallery of any of Proctor's theaters in New York, looking at some of the admirable railway scenes which the Kalatechnoscope throws upon the screen in front of him. Many of these pictures have been taken from the ground and may exhibit a "limited" train rushing past, and possibly making up time. Others are taken from the front of a rapidly moving locomotive, and these show the public how a railroad looks to the occupants of the cab.

The wonderful projecting machine with the name derived from three Greek words, is all the time busy reeling up a ribbon of transparent celluloid in front of a powerful electric lamp. The rays from this lamp pass through a lens, and are thrown upon a large white screen, so as to make the figures life size. This celluloid band contains a series of tiny photographs, each about one inch wide by ¾ of an inch high. These are really separate pictures absolutely devoid of the least suggestion of motion, each differing from the preceding one in an almost imperceptible degree, yet no two exactly alike. The machine runs at a speed which will move about 46 photographs past the lens every second. A moving picture lasting 45 seconds would therefore require a band of celluloid about 130 ft. long. The spectator as he views a picture full of varied life and movement, showing perhaps a gang of section men getting clear of an express train, at full speed, will enjoy the reality of the scene. At the same time he may not realize that the laws of mechanics and optics, acting together for his entertainment for the brief period of three-quarters of a minute, require the illumination, obscuring and shifting of no less than 2,070 separate photographs.

A Financier's Opinion.

In a recent interview with a reporter of one of our leading metropolitan evening papers, Mr. John W. Gates, an important Wall Street magnate, said, in discussing the railroad situation:

"The railroad interests of this country are to go through a continual process of consolidation. Small lines will be absorbed by larger ones. The tendency of freight rates in the United States will within the next ten years be lower, and yet the profits of the railroads will, in my judgment, be even greater with the lower rates, owing to the improvements in rolling stock and motive power, roadbed, the cutting out of curves and cutting down of grades and increasing train loads. A railroad president told me that within four months he will be hauling 3,000 tons net, of coal per trainload, where formerly—not more than five or six years ago—600 tons was considered a fair trainload on this same road, and this road at that time was in good physical condition. The standard of railroad men is being elevated. Closer comparisons are being made; the cost of maintenance of road, rolling stock and maintenance of equipment is being reduced. Greater care is exercised in the purchasing and engineering departments. Many men who twenty-five years ago were presidents or general managers of railroads would not to-day be considered sufficiently efficient to operate a logging road. The system of accounts has become a science and has been brought down to the finest possible point. Directors are not so reliant upon the operating men of their road, for the reason that they can now make comparisons for themselves. The amount of money paid out by railroad companies in rebates since the passage of the interstate commerce law in 1886 would, in my judgment, almost pay the national debt. What has made the railroads poor has been the carrying of people for nothing and cutting nominal tariffs actually in two in many instances. The railroad situation in the United States to-day is better than ever it was."

Highly Elevating.

The practice of making inanimate objects converse with one another, which has been so ably employed by Rudyard Kipling in several of his stories, has been adopted by the poet who wrote the five stanzas called the "Song of the Elevator," printed in a booklet which lately found its way into our office. It seems that two elevators in a large building in the city of Boston were overheard by the night watchman comparing notes. One of them was suffering from the defective-cable-malady, and wished for something which would "stop this constant stopping—constant stopping for repair." From an elevator existing in that city of refinement and culture, the words used appear to be somewhat redundant. It should, perhaps, with more propriety, have expressed a desire to possess a suspending medium of such enduring quality as would reduce the recurring periods of enforced inaction hitherto produced by lack of ability to successfully resist the frictional trituration of the pulleys, and the internal stresses induced by the attraction of gravity. Elevator No. 2, however, with a practical turn of mind, suggested as a remedy the use of a patent flattened strand wire rope made by A. Leschen & Sons Rope Co., 920 North First street, St. Louis, Mo. That was the "burden of his song."

A press dispatch from the West says that a fast freight run was made over the Montana division of the Great Northern by Engineer C. C. Smith with engine 806. The trip was from Havre to Glasgow, 154 miles, with 26 cars of cattle, in 4 hours and 26 minutes.

The gross earnings of the Chicago Great Western Railway (Maple Leaf Route) for the third week of June, 1902, show an increase of $7,986 over the corresponding week of last year. Total increase since the beginning of the fiscal year (July 1) to date, $527,082.79.

Ten-Wheel Engine for the Canadian Pacific.

The American Locomotive Company have just turned out of their Schenectady shops some 10-wheel engines for passenger service on the Canadian Pacific Railway. These engines are cross-compounds of the Schenectady type, with cylinders 22 and 35 x 26 in., with driving wheels 69 in. in diameter. The tractive power of these machines is about 25,530 pounds. In the matter of weight they are somewhat lighter than the 10-wheelers lately built at the company's own shops in Montreal, which we illustrated in August, the Schenectady engines weighing 168,000 pounds, of which 124,000 pounds rests on the drivers. These engines represent the latest practice in the design of heavy 10-wheel power, and have what may, without flattery, be called a most pleasing appearance.

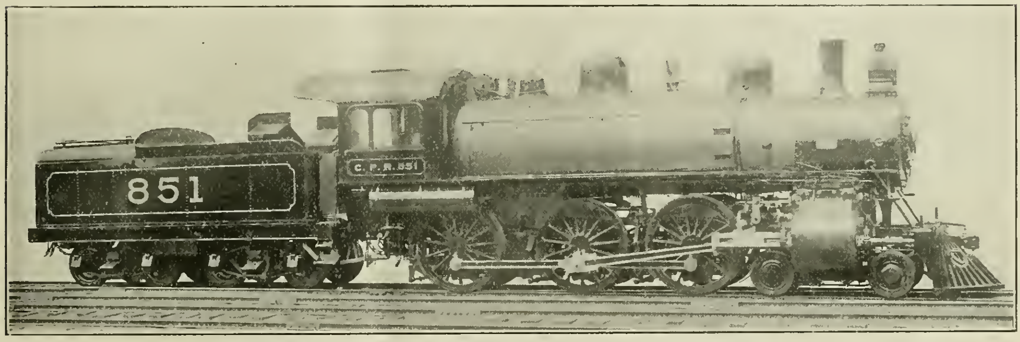
The cab is made of steel, wood lined, in accordance with C.P.R. practice, and is painted inside a light green. It is entirely without sharp corners, and the tops of the windows repeat, as a detail, the general rounded appearance of the well-lighted and roomy cab. This form of cab has been used on the road for many years. Formerly, when the present chairman of the board was general manager, he paid a great deal of attention to the details of construction of the engines turned out of the Montreal shops. On one occasion when the question of cab construction came up, the well-known artistic instinct of Sir William Van Horne manifested itself. In conversation with the chief draftsman he expressed a desire to have the cab made with the sharp corners removed. He hurriedly sketched a bird's wing on a piece of paper lying near, and handed it to the chief draftsman, saying, "Can you not make it something like this?" The draftsman readily responded, and the neat, flowing outline of the steel cab which has since become standard on the Canadian Pacific was thus evolved. The idea is both artistic and appropriate.

The valve motion is indirect, the valve rod extension bar passes over the leading axle. The valve itself is of the piston type, with outside admission. The crosshead is of the four-guide-bar type, with wrist pin cast solid, and the piston rod is extended through the front cylinder cover. The springs are all underhung, and the driving box hangers rest on top of the boxes with broad flat feet, which insure an even bearing.

The boiler is of the extended wagon top type, the gusset sheet sloping forward to the smoke box, gives plenty of steam room. The injectors are placed one on each side, the delivery pipe entering the boiler on the center line, 18½ in. back of the front flue sheet. About 24 in. below each top check a hand hole is placed, which facilitates the removal of sediment which is usually deposited below the checks. The steam dome has no mountings, the safety valves are carried on a separate mounting placed behind the dome. The whistle grows straight out of the boiler just behind the pop valves. In former designs the whistle was part of what is often called the auxiliary dome, and was placed inside a deflector plate used to carry the steam, when blowing off, up clear over the cab. The ash pan in these engines is large and comes down well below the trailing axle which gives the man who cleans the fire a broad flat surface to rake over. There is a hand hole 5½ in. diameter in the bottom of the boiler about 30 in. forward of the throat sheet, and there are eight wash-out plugs on each side of the boiler on the level of the crown sheet. Altogether the important matter of providing washing-out facilities has received very careful attention.

The tender has what is called a turtle-back tank, which, taken in conjunction with the rounded outlines of the cab, helps to enhance the pleasing outlines of the whole machine. A hand rail, we had almost said, but perhaps more correctly, a foot rail, is run around the back of the tank which is intended as a kind of warning to the fireman in case he should step too near the sloping edge when taking water. A tool box between the trucks under the frames provides a neat, convenient, safe and clean receptacle for jacks, bars, etc. These tools when oiled and put away in this box are ready for immediate use without having to be dug out of the regulation bed of fine cinders usually carried on the back of tanks. The turtle-back form of tank not only gives artistic finish to the tender, but emphasizes the fact that only useful fuel is to receive free transportation, the cinders have to look out for themselves as best they may and are expected good humoredly to fall in with new conditions and to take up their permanent position along the right of way with as little show of heat as possible.

Part of the equipment of these engines is Westinghouse-American combined brakes on all drivers; Westinghouse tender and train; 9 1-2-in. air pump, Westinghouse engineer's air signal. Two main reservoirs, 20 1-2 x 84 in., 50,000 cubic in. capacity. Some of the more important dimensions are appended:



TEN-WHEEL COMPOUND LOCOMOTIVE—CANADIAN PACIFIC RAILWAY

GENERAL DIMENSIONS.

Fuel, bituminous coal.
Weight in working order, 168,000 lbs.
Weight on drivers, 124 000 lbs.
Wheel base, driving, 14 ft. 10 in.
Wheel base, rigid, 14 ft 10 in.
Wheel base, total, 25 ft. 11 in.

CYLINDERS.

Dia. and stroke of cylinders, 22 x 35 x 26 in.
Dia. of piston rod, 3¾ in.

VALVES.

Slide valves, piston type, 6 in. travel.
Outside lap of slide valves, H. P. 1¼ in., L. P. 1 in.
Inside lap, clearance, H. P. ¼ in., L. P. ⅛ in.
Lead of valves in full gear, line and line.

WHEELS, ETC.

Dia. of driving wheels outside of tire, 69 in
Driving journals, 9 x 12 in.
Main crank pin, 7 in. dia. x 6½ in.
Side rod crank pin, main, 7½ x 4¾ in.; F. & B., 5 in. dia. x 4½ in.

BOILER.

Style, extension wagon top.
Outside dia. of first ring, 62½ in.
Working pressure, 210 lbs.
Thickness of plates in barrel and outside of fire, box, ½ and ¾ in.
Horizontal seams, butt joint, sextuple riveted, with welt strips inside and outside.

Circumferential seams, double riveted.
Firebox, length, 108 in.; width, 41 in., depth, F. 76½ in., B. 64½ in.
Firebox, crown staying, radial 1⅛ dia.
Firebox, stay bolts, iron, 1 in. dia.
Tubes, 2 in. dia., No. 11, B. W. G.; 312 in number.
Tubes, length over tube sheets, 14 ft.
Heating surface, 2273.3 sq. ft.; firebox, 171.96 sq. ft.; total, 2445.26 sq. ft.
Grate surface, 30.71 sq. ft.
Smoke stack top above rail, 14 ft. 5¾ in.

TENDER.

Weight, empty, 50,500 lbs.
Wheel base, 17 ft. 4½ in.
Tender frame, 10 in. steel channels.
Tender trucks, 2 4 wheel, with steel bolsters.
Water capacity, 5,000 imp. gals. Coal, 7½ tons.
Total wheel base of engine and tender, 54 ft. 6 in.

Testing Tube Welds.

The defective welding of wrought iron was recently proved by Mr. D. Woodman by chemical means. A number of boiler tubes had given very bad results, corroding rapidly, though another similar set had resisted well. Analysis detected nothing wrong with the quality of the material, which was practically identical in both cases. The welding was tested by laying sections of each tube in a 10 per cent. solution of sulphuric acid. The good tubes were attacked uniformly all round, the line of the weld showing merely by its color. The other tubes were eaten away very rapidly in the line of the weld, a deep slit being formed there, indicating that the metal was porous and open.

Speeds of Wheel Gear.

The following are considered the greatest speeds at which it is safe to run toothed wheels. The speed is that at the pitch circle in feet per minute. In bevel wheels the pitch circle is taken as that at the largest diameter of the wheel: Ordinary cast iron wheels, 1,800 ft. per minute; helical wheels, 2,400 ft. per minute; mortise wheels, 2,400 ft. per minute; machine-molded cast iron wheels, 2,000 ft. per minute; machine-molded steel wheels, 2,500 ft. per minute; machine-cut wheels, 3,000 ft. per minute.—*Ex.*

Chattanooga.

The city which the Brotherhood of Locomotive Firemen chose for their eighth biennial convention has been poetically called the "Gateway of the South." It is situated in the valley of the Tennessee River, and is surrounded by Walden's Ridge, Missionary Ridge, and the famous Lookout Mountain. It is an important city with a population of upwards of 50,000.

Near Chattanooga are the famous battlefields of Chickamauga and Missionary Ridge, while right in front of the city and visible from all parts of it, is the mountain upon which was fought "the battle above the clouds." The most oted landmark in Chattanooga is the old prison on the southwest corner of Fourth and Market streets. This is a three-story brick building and was used as an army prison by both North and South, as the city was successively held by both sides. The Read House, where the convention delegates stayed, stands on the site of the old Crutchfield House, which was used as a hospital during the war.

After the Federal forces under General Rosencrans had gained possession of Chattanooga, the Confederate general, Bragg, who had withdrawn to Chickamauga, determined to force a general engagement for the purpose of retaking the city. His design of flanking the Federal force was, however, discovered early on the morning of the 19th of September, 1863, and the battle of Chickamauga began. It was one of the bloodiest of the war, and was continued on the following day. It is estimated that the Union forces lost, killed, wounded, and missing, 16,179 men, while the Confederates sustained a total loss of 17,801. Neither army was victorious and each withdraw from the field. General Bragg, failing to retake the city, disposed his forces on Lookout Mountain and Missionary Ridge for the purpose of besieging the enemy. The Federal troops, cut off from supplies, were on the point of surrendering, when the arrival of General Grant, on October 23, changed the aspect of affairs. By November 18, his plan was laid to have General Sherman attack the Confederates near the north end of Missionary Ridge. Sherman did so on November 23, but was repulsed and forced to retreat. At the same time General Wood's division advanced against the strongest point in the Confederate line, on Orchard Knob, and after a sharp engagement captured the hill.

Next day General Hooker was ordered to take Lookout Mountain. He had a force something over 9,600 men. He crossed the river at Brown's Ferry and marched up the west side of the mountain and around to the front, where on the plateau below lookout rock he encountered the southern forces, commanded by General Walthall. The fight lasted until 2 or 3 o'clock in the afternoon. The Confederate troops withdrew during the night to Missionary Ridge. The "battle above the clouds" was really fought in a cloud and not above it, as that side of the mountain was shrouded in mist while the conflict was in progress.

The last of the battles in this vicinity was that of Missionary Ridge. General Grant commanded the Union army from Orchard Knob, which had previously been captured by Wood. Orders were given to take the entrenchments at the base of Missionary Ridge by assault. At a quarter past three the whole of the Union line charged. The positions were carried and instead of stopping, the army dashed up the slope, in the face of a deadly fire, and captured the ridge simultaneously in six different places.

Thus ended the conflict about Chattanooga. The whole historic ground is covered with monuments which recount the valor of the "brave boys in blue and gray." As showing how time has softened the bitterness engendered by the war, the inscription on the peace monument raised by Kentucky to the Union soldiers and to her own sons who fought at Chickamauga may be mentioned. The inscription reads: "As we are united in life and united in death, let one monument perpetuate their deeds, and one people, forgetful of all asperities, forever hold in grateful remembrance the glories of that terrible conflict, which made all men free and retained every star on the nation's flag."

Heavy Four-Wheel Cars.

Nearly all the railways in Great Britain are building a few freight cars of large capacity in an experimental way, being urged to that course by the reports of low cost of transportation made possible by the large capacity cars used in America. Most of those designing large cars carry them on two four-wheel trucks, and the designs do not differ much from the large-capacity steel coal cars becoming so common on this side of the Atlantic. A somewhat bold experiment has, however, been made by Mr. James Holden, locomotive superintendent of the Great Eastern Railway of England, who has designed cars to carry twenty long tons of coal on two pairs of wheels. His object in following this form of construction is doubtless to keep down the dead weight, and in this he is fairly successful. The dead weight of the car is 18,700 pounds, which is made to carry 44,800 pounds, being 20 long tons. That puts tremendously heavy weight upon each axle, and we should be afraid that there would be difficulty in keeping the journals running cool.

To Calculate Diameter of Circles.

"I wonder how many of my brother engineers know that the diameter of a circle, or a pipe, with an area equal to that of any two other ones, may be found without any calculation by means of nothing but the square corner of a board and a rule. The process is simply to lay off the two diameters on the two edges of the board and measure diagonally from one to the other. If you have a carpenter's square the process is reduced to the simple diagonal measurement. Where three or more pipes are to be led into one, convert two into an equivalent and work as with only two pipes. I find this simple method of great assistance in the engine room, as you can see at a glance, almost, what size pipe is required without any calculation."—*The Engineer.*

General Correspondence.

Adhesion and Tractive Power.

The old-style engine of the past, with the high wheels, low steam pressure, and small cylinders, had, as a rule, a fair amount of adhesion as compared to tractive force, and if the engine did prove "slippery," the resultant damage to train or equipment was comparatively light, owing to the limited power developed by the locomotive.

With the present type of mastodon, consolidation or decapod locomotive, however, a case of slipping will have a far different result, and for that reason the ratio of adhesion to tractive force should receive careful attention. In no case should it be less than 4.5.

The writer has in mind a number of large consolidation engines built in 1902, which, while first class in all other respects, are sadly crippled through lack of adhesion sufficient to balance the tractive power developed. Consequently it is only under the most favorable circumstances, no wind, good rail, etc., that the full tractive force of these engines can be utilized.

This unemployed tractive power can thus be considered almost as a dead loss, or if not exactly as loss, at least as money deposited where it earns no interest. However, it is not in the unutilized tractive power that the greater loss is developed. On the contrary it is in the damage resulting through insufficient adhesion, which produces what is termed a "slippery engine," which wastes fuel and wears itself out prematurely.

Railroading is too far advanced to permit old time car ratings to obtain, as in the past. The present-day engine is rated by tons, the rating based on the tractive power developed. In making ratings the weight on drivers is seldom taken into consideration, the power of the engine being calculated from the size of cylinders, steam pressure, etc., the natural inference being that the engine is properly proportioned in regard to adhesion; but as cited above, this is not always the case, even in the present enlightened age, consequently there is trouble in store for the man running the slippery engine.

The four principal causes of "break-in-twos" of long freight trains can be classed as follows: First. Hidden damage to draw gear, etc., while making up trains in yards, due to rough handling by switchmen. Second. Rough handling on the road, due generally, to engineer getting in a hurry in starting. Third, Releasing brakes at slow speed. Fourth. Slippery engines. The slippery engine being rated by tractive power, is generally overloaded. Consequently on slow, hard pull, or in starting trains, where the full power of the engine is called into action, the engine will "fly up" or slip.

An engine slipping practically comes to a momentary standstill; the acquired momentum of the train, however, forces the cars forward, up against the engine, bunching the slack ahead, compressing all the draw bar springs, etc. About this time the engineer has the sand running, the engine grips the rail and starts forward, while the compression in draw bar springs forces the train back and—out come the draw bars. The engineer is censured for a fault that properly belongs to the engine.

In speaking of causes of break-in-twos, the slippery engine was assigned to fourth place, but when cost of break-in-twos is considered, the slippery engine easily ranks first, as the break-in-twos from the three first-mentioned causes generally take place at a terminal or a siding where the passing of other trains can be facilitated, but the slippery engine is liable to fly up and part her train at any point, and consequently demoralize the traffic—on busy lines—by delaying other trains while chaining up, etc.

The above applies only to our modern heavy freight engines capable of exerting a high tractive effort, and consequently hauling long heavy trains. Passenger engines do not require quite such a high percentage of adhesion; in fact, owing to the limited number of driving wheels, it is not always possible to obtain it without so increasing the weight on bearings as to cause undue heating at fast speeds.

However, as before stated, the full amount of adhesion is not often required of passenger engines. In the first place passenger trains are proportioned to the speed required, consequently the full tractive power of the engine is not called into action in starting the train, and after the train has been lifted to the required speed, the tractive effort decreases with the decrease of M. E. P. and the balance still remains in favor of the adhesion weight.

F. P. Roesch.

Denver, Col.

Incompetent Boiler Attendants.

Nearly all men need pushing and reminding to keep them alive to the responsibility of the duties they perform, especially those in charge of steam boilers and of machinery liable to unexpected failure. From the reading of yours and of other railroad papers, I am inclined to think that the locomotive engineer gets more than his share of cautioning to be careful, but there are others who receive too little attention from the guardians of public safety. Foremost among the class that need more supervision is the small boiler owner. Self-interest is too often depended upon to make a boiler owner keep his boiler safe, but that is far from being sufficient to guard against reckless practices, and there are hundreds of boilers under the sidewalk in Chicago that would not pass an easy inspection.

Self-interest does not even induce boiler owners to employ help that will run the boilers at moderate expense. Most employers do not take into consideration that one engineer can consume from 25 per cent. to 50 per cent. more fuel than another; also, that expenses on repairs and other matters will be in the same proportion. The man has run an engine, and that is all that is required of him in the employer's opinion. As long as employers are of this opinion, who can wonder at boiler explosions? I simply wonder that there are not more, when we look about us and see how boilers are managed; blown out when the masonry is overheated; safety valves overloaded and corroded to their seats; gauge cocks stopped up; pressure gauges out of order; boilers corroded; flues choked, and other bad disorders. When we come to see all this, we wonder there are not more crystallized, distorted, sagged and twisted boilers, and not more explosions.

I once knew an old flue boiler that was so thin that the back end fell down, forcing the support through the shell. This boiler had been in constant use for many years; but business became dull, and it was allowed to stand for a short time nearly full of water; and when the engineer came into the boiler-room the day previous to starting, he found the boiler in this condition, evidently too weak to sustain its own weight.

I was once called upon to run an engine in a large leather manufactory. I found that the gauge cocks had not been in use for a long time, and could not start them from their seats. On making inquiry I found that the engineer had for two years depended solely upon an automatic water gauge. Now we all know that any automatic arrangement for indicating the water level in a steam boiler is not a reliable device, nor is it possible to construct one that is reliable. When boiler owners become convinced that patent damper regulators, automatic boiler feeders, low water alarms, fusible plugs, etc., do not, with an ignorant engineer, make a boiler safe and prevent explosions, the better it will be for the community, although I do not condemn their use, but rather encourage their adoption, if properly cared for by a competent man; but it would be far bet-

ter to pay their equivalent to a good man, rather than use them with a common laborer as engineer. I, for one, would not trust myself to labor in a building where they use an automatic boiler feed for pumping the water, and a common laborer to shovel the coal.

Chicago, Ill. BOILER INSPECTOR.

Lake Shore Front End.

There seems quite a general inquiry from railroads using the master mechanic's front end for something new in the way of a standard drafting arrangement for bituminous coal burning locomotives. The master mechanic's arrangement has never been satisfactory for steam, and because being so constructed as not to clear itself of cinders, extremely expensive on account of burning, warping and cracking the smoke box front if leaking air at all. It requires careful repairs to make a front air tight which has been warped or cracked by heating. The theory that some cinders must be retained in the smoke box was unfortunate and a fearfully expensive mistake, as is proven by the thousands of burned, warped and cracked smoke box fronts which disfigure the locomotives of railroads using this arrangement.

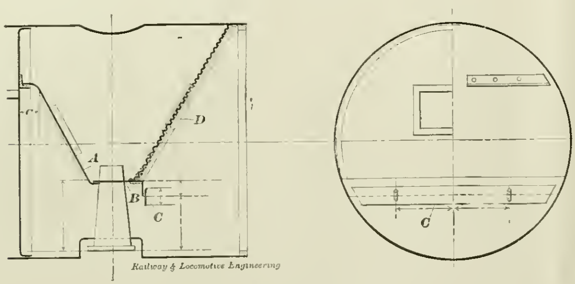
Instead of a spark retainer we want a spark extinguisher and smoke box cleaner, and, as can be demonstrated in court or elsewhere, it is more practicable and safer to construct and operate the latter arrangement than the former.

I am pleased to hand you a sketch of a front end which is standard with us and in use on all our engines, and which, for simplicity of construction, steaming qualities, freedom from failures and repairs and general efficiency for the purpose, I consider ideal.

You will note that ancient fake, the petticoat pipe, has disappeared. We have put it where it will be of a little use and cause no trouble, on the scrap pile. Now it is never out of plumb, there are no holes in it, it is neither too high nor too low, and the round house foreman is relieved of the trouble and expense of frequently adjusting it for some four-flusher who is only guessing. It never falls down, and when the front is once put together the engine steams right along day in and day out.

That other unornamental source of annoyance and expense, the cinder hopper, is eliminated also. Now it never burns, cracks or leaks. The hand holes on the sides of the smoke box are, of course, not needed. The absence of these things improves the appearance of the smoke box, and if it gets any care whatever it always looks black and neat. On new engines the additional length of box made necessary by use of the cinder well may be cut down to what is necessary for the internal arrangement, thus adding much to the general appearance of the front end.

If the few parts of this arrangement are well put up nothing will get out of line or fall down, and the front need not be opened except for the inspection of netting.



L. S. & M. S. FRONT END.

Referring to the sketch, we have called plate A the diaphragm, plate B the table plate, and plate C the deflector, because it deflects the draught to the bottom of the smoke box for the purpose of cleaning it. D is, of course, the netting and extends straight from the table plate to the top of the smoke box.

The distance "a" from the flue sheet to the diaphragm we make six inches. We formerly made it four, but found the engine steamed better if it were increased.

Fault has been found, because in the M. M.'s front end arrangement this sheet was set too nearly perpendicular, and it has been supposed that there was a resulting "back lash," so called, of the draft into the top flues. This has been compared to the action of a jet of water thrown from a nozzle at a right angle against an obstruction, some of the water coming back, of course, outside the lines of force.

I do not think any such action could take place, inasmuch as the impulse or pull comes from in front of this point. Probably, whatever the angle, the current must always be in the direction of the pull. However, a good space between the flue sheet and the diaphragm and as much pitch as practicable to the diaphragm no doubt gives better draft through the top flues.

The table plate B rests on top of the exhaust pipe and underneath the flange of the nozzle base. It should be cut out sufficiently to allow of the exhaust pipe being removed without disturbing the plate, the opening being closed by two small plates fitting closely around the nozzle and exhaust pipe joint. The exhaust pipe should be of such a height as will bring this plate a distance above the bottom of the smoke box equal to about 40 per cent. of the inside diameter of smoke box.

The deflector plate C should be adjustable and set at a distance above bottom of smoke box equal to about 21 per cent. of the inside diameter.

This adjustment is not too low for steam and will, if the front is not too long from the exhaust forward, clean the front completely. Should the front be too long, the table plate may be carried further forward before being flanged down for deflector plate.

We use brick in the firebox with this front, but it can be made to steam practically as well without.

We use with it in our large 20 1-2 x 28-in. passenger engine a 5 3-4 exhaust nozzle, and in the 21 x 30-in. freight engines a 5 3-8-in. nozzle, but, of course, as all practical men know, the size of nozzle with any front will depend much on heating surface, grate area, kind of service and quality or fuel used.

The feature of self-cleaning of this front does not, as might be presumed, result in throwing fire. We use a 2 1-2 x 2 1-2-in. mesh netting and throw no fire at all, the sparks being broken so small that they are completely extinguished before being expelled.

O. M. FOSTER.
L. S. & M. S. Ry.

Callinwood, O.

How to Locate a Blow.

On the seven-by-nine railroad we have a man who can locate blows in piston valves, etc., to beat the band. Archer, who runs a 4-8-2 engine of the "Mongoose" type, has a way of his own. He runs out of Grafton and has a pretty long lay over at Farhaven at the other end of the division. Up at Farhaven the boys are good natured and like to keep things "a-moving," and they help Archer out a lot. The other day going up he thought he heard a left piston valve blowing. He didn't test her any when he got to the round house, but just booked the left valve, as cool as you please. Well, when the valve was examined it was as tight as a drum, and they chaffed Archer a bit, but he didn't say much—just thought. After he got back to Grafton he made a bang-up test

right before a lot of wipers and engine men and all. On the ash pit siding he put her on the bottom center, right side, plus three-fourths of an inch back, close measurement, applied the brake in the emergency, opened and closed the throttle three times in succession, listened like blazes at the fire door, and whistled twice, lit his torch and held it to the right valve stem packing, and then said, very wise-like: "It's the right valve." After they had the valve out and found he was right, every one crowded round and wanted him to explain how he got "next" so fast, but Archer said he hadn't time to tell it all, for it was simple enough when you knew how, but pesky hard to get straight without practice. His fireman stood there and guyed those gaping rustics, and said Archer caught it flat like the King of Siam every time by his "method." So he did, but if the engine had eight valves Archer'd need seven constructive round houses before he could work his method off. We call it the "King-of-Siam-plan" for short, but it's a dead right dandy, every trip. Sure!

I. C. Thruer,
Road Foreman of Engines.

American Balance Valve Co.'s Valves All Right in Australia.

The letter I sent to the American Balance Slide Valve Co. at Jersey Shore, Pa., was returned to me through the dead letter office. About their balance valves we discovered the ailment after the engines, two of them, had been in service for about 15 months. When running in first or second notch out of center and light steam they went "lame" only three beats; more times only two, and a roar as if valve was stuck up in buckle; but you could start out of a station or go up a hill. When engine was pulling hard everything worked O. K., but as soon as you eased throttle she got to her lame tricks again. Some of the men got frightened at them and reported valves stuck in "buckle," or "valve yoke" to exam. Valves were examined. Nothing wrong could be found with them. Well, as one belonged to your humble servant, and I had about a thousandandone questions to answer, I wrote to the American Balance Slide Valve Co. about them. And fancy Mr. Harrow when my letter came back through the D. L. O. However, one of the other chaps who had a sister engine came in one night and reported "piston rings broken to exam." Piston rings were broken in a dozen pieces. New rings were put in and all went O. K. So then the others came to the conclusion that my rings were broken and I did not know it. I won drinks that rings were not. And on examining them the fitter, who had put them in new, did not give them enough draw; so that when they wore a bit thin and were tight against the walls of the cylinder the steam used to pass underneath them and piston head when running with light steam; but new rings put a stop to all the lameness. I have not bothered any more about writing to the A. B. S. V. Co. And with "Mr. Topping the Second," the chap with the broken rings, down to myself, it has been a nine days' wonder.

Frank Anschan.
Maryborough, Queensland, Australia.

Some Reasons for the Auxiliary Dome.

With the advent of the ponderous freight locomotives and the large passenger machines, so common now, the auxiliary dome has been introduced, and for two distinct reasons: First, suppose a heavy consolidation was blowing off hard under 210 pounds pressure, from pops which were located in the steam dome proper, only a few inches above the throttle valve, and, at the same time, the throttle was thrown open, the large amount of steam rushing out of the boiler at practically the same point would be very likely to draw more or less water into the dry pipe, and thence into the steam chests and cylinders, which, as we all know, would cause trouble and probably delay and expense. On the other hand, if some steam is rushing out at one point, and some at quite at another place, the tendency to lift the water into the dry pipe is much lessened, since the two, exhausting at the same time, counterbalance one another, so to speak. With the safeties and whistle in a separate dome (the prevailing location just now) this equalization is more nearly realized. Second, if the relief valves and whistle are removed from the steam dome the boiler diameter may be increased from 3 to 6 in. without interfering with bridges and tunnels. Every master mechanic can appreciate the difference between the generating capacity of a boiler 66 in. dia. and one of 72 in. Hence, besides lessening the chances of engine priming, the auxiliary dome allows more boiler room, which means more power, which means ability to haul a bigger train, which means time saved, which means money earned.

And as long as giants like the A., T. & S. F.'s Mastodons, or the New York Central's "Atlanticers" continue to be built, we may confidently look for the auxiliary dome, in spite of the fact that it makes "another hole in the boiler," as some one expressed it not long since.

Armour P. Payson.
Inwood-on-the-Hudson.

We understand that Mr. George Gould's private car, Atlanta, now being completed at the car works at St. Charles, Mo., and which, it is stated, will be a veritable rolling palace, costing $150,000, is being equipped with the consolidated "Axle Light" system of electric lights and fans.

Conditions on the Air Line.

By A. Sup Lyman.

Third Paper.

A week had passed since the supply man had said good-bye, in the meantime the 653's poured in faster than ever. The "old man" felt that a crisis was at hand, felt like he did at 3 o'clock of the 21st day of the boy Tom's fever years before: he thought it about time for the turning point—or the end, when the 896 rolled up to the cinder pit and two begrimed individuals dressed in soiled overclothes and carrying grips, dropped off on the side next the little office.

The old man had seen Turner in uniform before, he recognized his quick business-like step; but who was the stranger? They were both up on the walk before he discovered Grayham, the trainmaster, through a veneer of coal dust, the first time he had made his appearance in that vicinity without a standing collar and clean patent leather shoes. The old man recalled the fact that Turner had mentioned his intention of taking Grayham out with him, but the taking and his return in his present condition was a surprise, his cordial greeting and warm handshake was another. The old man and the "office" had never met this way before, they generally exchanged compliments over the 'phone, and the little lady that sang "hello" in contralto, repeatedly complained that the language used over this particular wire was not always complimentary.

"Boys, where did you come from?" was the old man's first greeting, a warm wave seemed to have struck the office suddenly—the morning was a chilly one. "Out the front, doing the strenuous," was Grayham's reply "We've been over the second district to be explicit" added Turner. The trainmaster seemed to have taken on a new attitude toward the master mechanic, who in turn was quick to respond, and, Grayham, continuing, said: "When Turner offered to buy me a suit of clothes and a box of cigars if I would go on a week's outing, I could not resist. I'm glad I went, Mr. Barker, I've picked up a few things, too, and I might as well be frank and say that the things I learned will help us to get on better in the future, I believe. The Air Line ought to make Turner assist G. M., though, really, we need him, we have a great many things to tell you of after we get a bath."

"Boys," said the old man, with a perceptible tremor in his voice. "I don't like to discourage white ribbon work—Hannah is president, you know, but kick that door to and take a bath with me."

As Turner closed the door (he had bathed there before) the old man dove into the lower drawer of his desk and produced the—tub. "Here, boys, this is old enough to vote, smooth as signal oil, I keep it for Parsons when he comes. Pity, isn't it, the way the governor is go-

ing—won't last long, the smartest motive power man in the South, too. You both need one. Grayham, take the bottle with you, I wouldn't trust Turner, he is not used to good stuff. John Stewart, the general manager, is to be up on four this evening; Williams has got him stirred up. The general opinion is that there will be some change in our manner of operation. We are all to meet in his car to-night for a council of war. Come up, boys, and tell what you saw; it may help us to reach a partial solution at least. I dread this Winter coming on, our power is away behind what it was a year ago, and you know what we had to fight last Winter—I've been here 30 years, and somehow things seem to get harder every year. Meet me at the depot when four comes in, and talk some, too, I want to listen to-night." Mr. Williams wired me to come in for this meeting," said Grayham; "Turner will be there, don't fear, he would break into a Chinese funeral, be welcome, too, in twenty minutes, chief mourner in thirty, and be using chop sticks in forty. We will let him talk, he can do it; I'm sorry we had to come in before we got over the third, that is the real storm centre, you know." "Does the 300 carry any old signal?" asked the supply man. "If it does I will cancel a few engagements with prominent people and struggle up for a moment."

That evening the party, Mr. Barker, Grayham and the supply man were at the depot waiting for number four. She was reported out of Gray's Lake on time, but she rolled into the depot thirty minutes late. Superintendent Williams was in the 300 with the G. M. He went down on five to meet him and a hot main pin on the 486 gave him material to discourse on. He had the G. M. soaked full of the idea that the grease cups that the old man had adopted as standard was the "last fool move" when the train stopped. When the handshaking was over and the dinky had pushed the car in on the supply track, the G. M. opened the ball by saying: "The Air Line seems to be up against it, Tom, what seems to be the difficulty?"

The master mechanic had rare confidence in the ability and discernment of John Stewart. He knew that every man and everything received a fair trial at his hands before he rendered judgment. Of late the acquisition of new road had taken him entirely away from the operation, and now that he was on the ground he felt that things would soon loosen up on the Air Line. "John, we have too many troubles to even try to mention them in one evening; shortage of power, too much business for the facilities we have, too many new men of a certain kind, insufficient help of another kind, and most of all, John, you expect too much of what you term the monthly men.

"We had a job two years ago; we are slaves now. When the whistle blows the shop men go home, clean up and read the paper, their time is their own, then is when our real work commences. We all go back after supper, I've got eleven of Mr. Parson's men cooped up in different places. There's McAdams, he has swallowed round house gas for twenty-four years. Ask Williams there as to his capacity, he will tell you that Mc. gets engines out when the train sheets don't show one in the terminal. He is at the house until one and six get out, after midnight, seven nights a week. LeClair, my boiler man, is in his shop with an evening shift until 11. They each get the same wages that we paid in the hard times when the shop worked forty hours a week, and we borrowed a saint's calendar to hunt new holidays from to shut down on. There's the road men. When business was dull we depended on the old men to assimilate and educate the few—very few—new ones that broke into our exclusiveness. We've put them out so fast of late that the old men have all they can do to take care of their lives. We never thought an examination worth while then, passed up the air car even when it was offered us. Now we seem to be all adrift. Sane men do things daily that are not on the records of the worst road in the country, and here we are a trunk line, three first-class terminals, too.

"Williams here has five of my best men off on the second district. I had to pick up what I could to put in their places. Two of the five are over on the Western. The road end is not looked after, John, and that is why the money is made, where the 653's are made, too." The superintendent raised his head at this sally. "We seldom have engine failures in the shop and round-house, though we fix for a few, I think.

"I must have some help on the road,. I've ran an engine myself, but things get away from a man who is off the road six months. It is twenty years since I made a close run for water. Things were different in those days. We agreed that we could not afford a traveling engineer. Williams has one trainmaster for 452 miles of busy road. He couldn't touch the high spots with an air ship. I want more money for my men, the engineers, firemen and shop men all were given a raise. McAdams, LeClaire, Haskins and the rest know that as well as the timekeeper. You've bought enough road now to put this line past the stage where it would run itself; you will have to pay for the running if it is to be well done. Here's Turner paid a salary by the injector people; he got Grayham into the first suit of clothes that really became him, and together they went over the second district for a week. They can tell you more of the road than I can, I've been swamped for four months; they told me of things I did not know." The G. M. nodded to Turner, who was quietly smoking, and who in reply to the nod, said:

"You know, Mr. Stewart, I have lots of spare time. Besides, Mr. Barker and father were old friends, and as I had promised Grayham here an outing, he went over the second, just got in this evening. I agree with what Mr. Barker has said—the engines could do the work if they were properly rated, kept up and moved. The rating that exists at present would paralyze any division. We came up on first twenty this morning, caught it at the junction. They doubled five hills, forty-six miles, ran fourteen for water. That makes sixty added to one forty-two made a division over 200 miles long. The fire was so dirty that the flues began to leak, and after the fireman gave out they reduced 50 per cent. at the junction. There's a light engine gone after the head end now; they get a hundred miles for sixty-eight. Grayham refuses to discuss the rating question; perhaps you know where it comes from?" The G. M. looked at Williams, but said nothing.

Continuing, the supply man said: "Then the rush swamped the men, and, worse still, your officials, who simply cannot touch things, as they have gone without help. Your men get the best pay in this section. They are good men, they know that their work is miserable, but they are milling like a bunch of Texas steers, the leaders in the center going round with the rest. You will have to get some good men on the outside to quiet them. Half of the engine failures, yes, two-thirds, are due to lack of steam. The engines that have the least heating surface steam the best. That shows that the trouble lies more in the condition of the engines, the arrangement of draft appliances, and the firing than it does in the coal used. Those 600's you bought a year ago want going through, the steam and exhaust pipes and front ends want touching up, and they want coarser grates put in them. The refuse in this coal must be gotten rid of. Through the grates is the only way to rid the firebox of it on the road; that calls for self-dumping ash pans, you need them worse than you do those "merry-go-'rounds" you put up in the cab. Men cannot stand fighting the heat above the deck line between stops and then tackle the dirt, heat and gas of a full ash pan when on the siding. Clean ash pans would double the capacity of your cinder tracks that are overworked at most points now.

"Outside of the steam and dirty fire question your failures are not so numerous, a little organization out on the road can cut out half of what is left. There's them new pumps on the 600's, they are not the best pump in the world, but they will do if taken care of, give very little trouble, in fact; there are worse parts of the apparatus than the pump,

they won't stand speeding. Most of the men condemn them when they sign the call book and open them up wide when they reach the engine, then failing to get any free air in the high pressure cylinder, they heat and the rings contract and jam in the piston, and they are done till they go through the shop. Bill Johnson is getting good work out of the one he has on the hill, been up there two years. He just runs it slow and oils it, that's all. The two departments should organize and form a partnership to fight delays, change the gait to a quick step, even if you have to cut the trains a couple of loads. The last two on first twenty this morning cost a hundred dollars."

The general manager looked over toward the superintendent again, but said nothing. With scarcely a pause, the supply man continued: "As a first step I would suggest that you give every division its share of the power. The engines that once belonged to the men on certain districts don't even belong to the district now; guess the stockholders must claim them, though, for you can find Air Line on the side of the cab by wiping hard. The present plan guarantees an absolute lack of responsibility and interest on the part of everybody; I won't exempt master mechanics even. The pool cut the men's interest out, but this second pool cut the foremen out after them. If an engine has developed a weakness, bad flues, mud burnt fireboxes, sharp tires, anything, in fact, instead of remedying the trouble, every trainmaster and round-house man schemes to give her to the other fellow; they kick her on and finally she comes in ten cars back in the air. If Grayham here on the second rushes up four or five lights to clean up old loads, Casey on the third takes them. That doesn't encourage our friend on the second; you can't blame him for taking a half day off to see the home nine wallop the nine from Casey's terminal.

You must have some good, wide-awake traveling engineers, practical men, who can jump out on a heavy night run and give the new beginner some pointers and incidentally a little confidence. Don't do as the O. & B. did, though, grab up all the committee men regardless of ability. What you want are men who know an engine and a man at the same time. If the Air Line has not got them, hire them from some other road. I would call those men road supervisors. Give them authority enough over train men to at least drag the rear brakeman away from the hypnotic influence of the lunch counter girls, those at the eating stations, I mean. Since Mr. Parsons took sick Mr. Barker has been the real head of the machinery department. He is overloaded, some of Mr. Parson's men are here, the rest up at Jamestown; that makes the work harder still; he is willing to do all he can, but he deserves help. I would cut out this suspension business, go back to the Brown system make it a record system, if you don't want to use the marks; put some of the old men back—there's Olesen, you can't afford to lose that kind of a man, make effort and character count, and don't be too hard on promoted men. It takes two years to get them lined up, you can cut that to ninety days if you will organize an educational policy like the Bee Line has gone into. They pay for educating their men, no salary deductions made on their pay roll. You want instructors here, class rooms and an air car without any coupon attachments. I could talk all night, that's one of my weaknesses, but I see Grayham is nodding, he is not used to riding tonnage trains."

"Gentlemen," said the general manager, rising, as if to dismiss the party, "I will be here for a day or two, the board meets on the 31st, and if you will kindly meet me here at 9 in the morning we will plan a few changes; I think we can get together and accomplish something. Mr. Turner, I wish that you would wire your president, he is an old friend of mine—wire to-night and say that I would esteem it a favor if you were to stay with us a few months. You will oblige Mr. Barker in this case, I am sure. Mr. Williams, kindly remain a few moments." With gentlemanly courtesy, he stepped out on the platform to say "good-night, 9 in the morning, gentlemen," and shaking hands with the old man, he bowed him off the lower step.

"I see light ahead," remarked the old man, as they stopped at the hotel for a cigar. "Did I tell you of Gibbs' experience with pooling on the third?" remarked Turner, who always parted with a story.

"You know he was over the road for the brake people. Down at Carson they don't enjoy a steam laundry, and Gibbs gave the hostler's helper his laundry. All coon helpers there, you know. Next day he met a sporty looking coon wearing a familiar looking shirt, with the initials E. L. G. on the front. Tackling the helper for an explanation, he was informed that 'de gent waring yu shut, sah, was Henry Clay Jones, fren of mah wife's, sah, potah at de deepo, sah. Heh brunged it back, sah; heh won't hurt it sah.' When Gibbs mentioned the matter to Carpenter, the foreman, he advised him to follow his example and get his shirt so dirty that the washlady's 'frens wud not wah dem sah,' guessed that pooling was a contagious disease, anyway. Gibbs said he didn't know whether to call it pooling or chain ganging.

We have reduced the price of Machine Shop Arithmetic from 50 cents to 25 cents. A limited number are on hand, so persons wishing a good book for a trifling sum should send their quarter without delay. Postage stamps will be acceptable.

Which Type Is This?

The great "Mogul," riding on a simple "decapod," met the "Mikado" out hunting. By "Columbia!" he exclaimed, "I would like to join you." So he did, and this "consolidation" of forces roamed over the "prairie" to the "Atlantic." They caught nothing, though their "single driver" was an "American," as "mastodons" are extinct, but their "10-wheel" auto ran like a compound "4-2-6," and they returned with great joy.

Wants Convention Held at Colorado Springs.

I have heard it whispered many times, of late, that there is a strong pressure being brought to bear to have the Master Mechanics' and Master Car Builders' conventions meet in Chicago during the season of 1903.

Now, I, for one, wish to enter a protest against the convention being held in Chicago, Philadelphia, Pittsburg, New York, or any place where there is a liability of the members being kept away from convention duties because of the numerous other opportunities and inducements which are to be found in such cities.

I think it should also be considered, owing to the trouble to get transportation for the members and their families, to hold the convention at some other point than Saratoga, although we must admit that that place is well fitted for it, still, I believe that it could be held at Colorado Springs, there being extensive accommodations at Manitou and Colorado Springs. I believe it would be beneficial to our eastern members to have an opportunity to meet in the western country, and I hope you will use your best endeavors to defeat any attempt that may be made by any committee which is aiming to have the next meeting held in any of the cities mentioned.

JOHN TONGE,
M. M. and M. C. B.

Minneapolis, Minn.

Stations and Passengers.

In the course of the report which the London County Council tramway experts have drawn up regarding their recent visit to America to study the Shallow Underground Tramway system, there is an interesting table setting forth the number of passengers using, per year, some of the most important termini in the world. The table is as follows:

Grand Central, New York	14,000,000
South Union, Boston	21,000,000
North Union, Boston	23,108,000
Broad Street, London	27,000,000
Park Street, Subway, Boston	27,400,000
Waterloo, London	28,659,000
St. Lazare, Paris	43,032,000
Liverpool Street, London	44,377,000

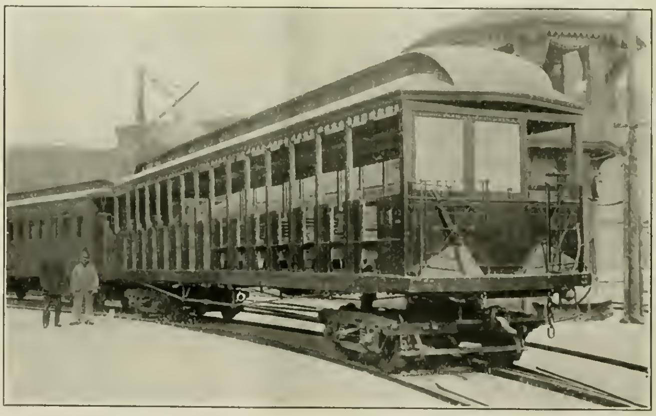
New Cars on the Manhattan Railway.

The Manhattan Elevated Railway Company, commonly called in New York the "L," has, with the gradual electrification of their lines, introduced some new cars, which are here illustrated. The regular motor coach does not differ materially from the coaches which have long been in service. The seats, with the exception of accommodation for 16 persons in the middle of the car, are arranged along the sides. The total seating capacity is 48, which is not large when the size of the floor space is considered, the car being 47 ft. 1 in. over all and 8 ft. 9½ in. in width. The side seats have individual cushions, but the divisions do not form arm rests as in the older cars; they indicate the space for each passenger. The cars are very satisfactorily lighted and heated by electricity, and no dust and germ-collecting matting is used upon the floor, wear being provided for by narrow raised slats of hard wood screwed to the floor.

STANDARD TRAIN OF CLOSED CARS, MANHATTAN ELEVATED RAILWAY.

The arrangement made for the motorman is admirable, and shows considerable ingenuity in the economy of space. The motorman is inside the car in a small compartment measuring 2 ft. 7½ in. by 3 ft. 4 in. He faces the window at the right side of the door, and while fully protected against wind and weather in his well-lighted, warmed and ventilated "box," he has an unobstructed view of the line ahead, and is completely shut off by a curtained door from any interference from the passengers. Each motor car has two such compartments, but in the whole train only a single one is used, and those compartments not occupied by the motorman are each available for the accommodation of two passengers. The electric closed car train, therefore, has seats for merely two passengers less than the old steam propelled train of same length. The motorman sits at the proper height on a stool which can be folded out of the way when not required. He has before him the controller and a Westinghouse engineers' brake valve somewhat similar to that used on a locomotive, with this difference, however, that it has a deep notch for lap position. The brake valve handle is carried by the motorman, and it can only be removed when the valve stands on lap. A brake valve, out of service, always has its ports blanked. Both controller and brake valve are close to the window sill, while overhead are the electric switches, fuses and the conductor's valve. Outside is an air whistle for warning section men or others on the track, and beside it, easily within reach of the guard, is the knob for operating the conductor's valve. When this compartment is not in use the door which shuts the motorman in, can be opened back against his window and locked in that position, so that controller and brake valve are effectually beyond the reach of meddlesome hands. A hinged seat when let down provides for two passengers, who, if they be congenial spirits, may have a snug little tête-a-tête together. The outside of the car shown in our illustration represents the motorman in his box, with side and front windows at his disposal. The electric headlight is on the roof with the colored side lights to indicate destination or character of train.

When we come to examine the open car we find a further manifestation of exceedingly clever design with an appreciation of conditions and means to meet them, which is deserving of great praise. The open car, which is not a motor car, has wooden seats with overturning backs similar to those of an ordinary street car. At the end of each seat, the wooden partition whose top constitutes the arm rest, is made so as to inclose a sliding door, which, when the car is in motion, blocks about seven-eighths of the passageway. These doors stand upon a bar of iron which runs upon rollers on the car sill and is operated by the guards at each end, each guard moving half the number of doors on each side by levers placed on the small platforms with which these cars are provided. On the right side, for instance, when the car is at a station platform, the forward guard opens and closes the front half of the car doors on the right side by the movement of a lever, and the rear guard, by a similar operation, opens and closes the back half of the car doors on the same side. The lever operates a bell crank with two links provided with universal joints, all



STANDARD OPEN CAR, MANHATTAN ELEVATED RAILWAY

of which rigging is neatly boxed in, on each platform. The closing of all the doors on a side is, therefore, very easy and is only the work of a moment. The car has canvas shades which slide in grooves and which remain in whatever position they may be put. Ample light is obtained at night from a row of incandescent lamps arranged along the car roof close to the clearstory. In the open cars smoking is permitted on the eight rear seats and the total seating accommodation is exactly double that of the ordinary closed cars. These cars unload themselves, if one may so say, very much faster than the closed cars, so that, although more people are carried in them they have the advantage of actually saving time for the company at stops, as well as being exceedingly popular with the public. This open car is a distinct advance in the matter of elevated railway car design, and the only regret is that its ample seating capacity and its ready means of ingress and egress have not yet been applied in some suitable form to the regular motor cars. The officials of the Manhattan "L," however, may not yet have exhausted their undoubted ability in car construction and design.

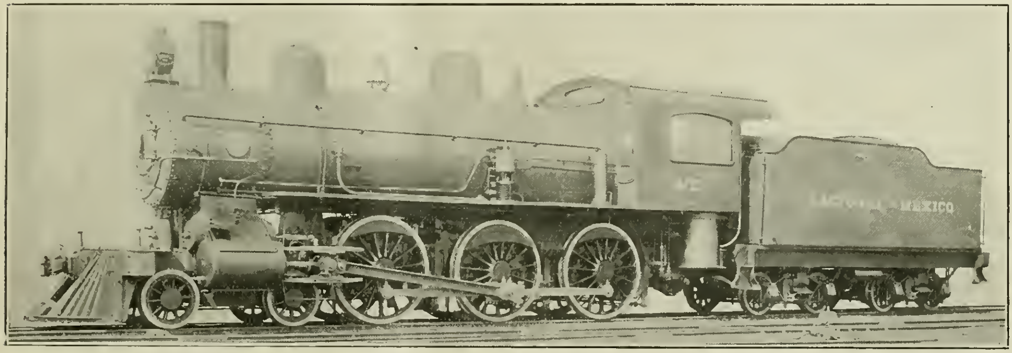
Not only has the opportunity for a most enjoyable trip been afforded to patrons of the road by the introduction of these admirable open cars, but with them overcrowding is a thing of the past. When the open car is filled that is all about it, and as passengers are not permitted to stand, wedged in between the seat backs and the knees of those who are seated, the side doors are then not opened. The recognition by the company of the principle that when the seats are all occupied, the maximum permissible load is being carried on the car is most important, even if such recognition is restricted at present to the popular open car.

The cars are substantially built and neatly finished. The open ones come from the shops of the Jewett Car Works, Newark, O., while the new motor cars were built by Wason, of Springfield, Mass.

Ten-Wheel Engine for the Mexican National.

The 10-wheel passenger engine here illustrated was built at the Brooks Works of the American Locomotive Company for the Nacional de Mexico, and is one of an order of ten. The engine is simple, with 20 x 28-in. cylinders and 68-in. driving wheels. Among the points of interest it may be mentioned that the starting power is 28,000 pounds. The adhesive weight is 4.75 of the maximum tractive power. This valve insures the maximum draw bar pull under average conditions of rail, without the use of sand. The total weight of the engine is 172,000 pounds.

Cast steel has been used very freely in the construction of this engine, and it may be mentioned that the lifting shaft arms, guide yoke, engine truck frame, center plate and suspension links, are of this material. A clever oiling arrangement is to be found in the cast steel expansion links. Small projections are cast on, just above the eccentric rod pin holes. These projections are each drilled almost through, transversely, thus forming a ⅝-in. hole. This cavity is intended to be filled with curled hair, kept in place by a small plug. An oil hole ¼-in. in dia. is drilled from the top, through to the eccentric rod pins. These are inclosed in case hardened steel bushings. The inner faces of the link are also case hardened. The crosshead is of the two-guide bar type and is made of cast steel, as are also the driving wheel centers, pistons, driving boxes, motion rod hangers, and spring saddles.



TEN-WHEEL SIMPLE PASSENGER ENGINE—MEXICAN NATIONAL.

The boiler contains 348 iron tubes, and the total heating surface is 2,753 sq. ft. The staying is radial, and the position of the crown sheet, which is level, insures large steam room. The diameter of the barrel outside the first course is 67⅞ in.

The appearance of the engine is that of a well proportioned machine, in which the clear cut lines of the various mechanical details help to make up a harmonious whole. The headlight has an acetylene gas burner, and the gas generator may be seen as an upright cylinder on the running-board just in front of the fireman's cab window. The 7,000-gallon tender, with 12-ton fuel capacity, indicates that this engine has about reached the limit for passenger service in this respect.

The Mexican National Railway has recently widened its gauge to the standard width used in this country, and incidentally has caused the Mexican Central to awaken to the fact that standardization of gauge is a most important factor in successful competition. The Mexican Central, though standard gauge, had the "long haul" without transfer at interchange points, while the Mexican National, when narrow gauge, had the "short haul" with transfer. The widening of the gauge, however, will give the Mexican National the shortest route between the border and the City of Mexico and connecting points. The engine here illustrated is built for standard gauge track, and is as modern in its design as the road over which it will have to run.

A few of the leading dimensions are as follows:

Fuel, bituminous coal. Cylinders, 20 x 28 in.

Weight, leading truck	30,000 lbs.
Weight, driving wheels	133,000 lbs.
Weight, total	172,000 lbs.

Capacity, tender, water, 7,000 gals.; coal, 12 tons.

Wheel base, driving, 14 ft. 6 in.; total engine, 25 ft. 7 in.; total engine and tender, 56 ft. 3½ in.

Heating surface, firebox	177 sq. ft.
Heating surface, tubes	2,553.7 sq. ft.
Heating surface, total	2,753.7 sq. ft.

Grate area, 35.1 sq. ft.

Boiler, type, extended wagon top, radial stays.

Tubes, 348; length, 14 ft. 15/16 in.; dia., 2 in.

Size of firebox, length, 124 in.; width, 42 in.

Valves, lap inside, 1⅛ in. Lead in full gear, 1/16 in.

Wheels, leading truck dia., 33½ in.; driving, dia., 68 in.; tender truck, dia., 33½ in.

Journals, driving, dia., 9 in.; length, 12 in.

Journals, leading truck, dia., 5½ in.; length, 12 in.

Journals, tender truck, dia., 5½ in.; length, 10 in.

Exhaust nozzle, dia., 5⅜ in.

Stack, dia. inside, 15 in., tapered.

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Useful Phases of Self-Help.

The time was when the majority of railway enginemen and trainmen despised information concerning their business, which was taken from books. The book studying engineer was looked upon with pitying contempt by those who boasted they knew nothing, and did not wish to know anything, which was not acquired by observation and practical experience. This class of men never learned more than the simplest and most rudimentary knowledge of their business, but their views or prejudices were popular and for long obstructed the growth of sentiment in favor of enlightenment. A locomotive engineer who is now a prominent road foreman of engines, and a strong advocate of book instruction, recently told the writer an incident of his early ambition to learn all he could about the locomotive. He bought a well known instruction book on the locomotive and he was so much pleased with it that he told the engineer he was firing for about it. The engineer asked him to bring it along next trip and he would look at it. This was done and when the engineer looked it over he pitched the book into the fire-box, at the same time using some profane language about books and people who read them. When the period came round that required engineers to pass an examination concerning air brakes, this engineer was taken off passenger service, owing to his ignorance of air brake mechanism and for the notoriously rough way he braked trains. This is only one of numerous cases where the cultivation of ignorance proved an expensive practice.

The sentiment in regard to acquiring knowledge is very much changed to-day, especially among younger men. The prevailing feeling is not against book learning, but thousands of men are striving against great obstacles to acquire knowledge about their business from books, from periodicals of an educational character like RAILWAY AND LOCOMOTIVE ENGINEERING, and from technical school instruction papers. The desire for education is very active; but a large proportion of those who are willing to purchase educational facilities find that they are unable to make use of what they have purchased for want of training in study. However ambitious a person may be to acquire knowledge, he will find it difficult to learn things by private effort unless influences are around him which tend to stimulate him to persevere in study. We have often heard it asserted that the most valuable influence of a college course is that it trains a person to study. This training is remarkably hard to acquire by one who has been in active work for eight or ten years since leaving school, and has given no thought to learning things. This is why so many persons fail to persevere in the study of subjects relating to their business, after they have purchased papers, books, or a school course with the intention of acquiring knowledge.

People who have been for years engaged on active physical work nearly always become mentally indolent, and it takes a wonderful amount of self-denying perseverance to overcome this indolence. Unless this indolence is conquered a person will make very unsatisfactory progress in studying any subject. A common spectacle is to see a man go home after the day's work is over, with his mind made up to begin studying, say his air brake catechism. After supper he goes out to take part in some active amusement, or perhaps he devotes himself to working in the garden or doing some household work which is cheerfully undertaken, and bedtime comes without the catechism being reached. And so the distasteful studies are put off from day to day; and good intentions bring forth nothing but procrastination, that thief of time.

The writer in his youth belonged for years to mutual improvement societies, and he has the best of reasons for believing that their influence kept alive a love of study, and did much to direct his studies in useful channels. Every town where ten locomotives lie up over night have now enough railway men interested in learning their business to make the material for forming a mutual improvement society or a class for study. We advise the men in such places, who are anxious to study the science of their business, to associate themselves together and form a class of the kind mentioned. The saying that "in union there is strength," applies very forcibly to the influence which union exerts in stimulating men to study, or to any other self-denying labor. A solitary student early in his search after knowledge, encounters something that he does not understand, becomes discouraged and very often throws up the work as being beyond his capacity. When two or three work together the difficulty which floors one person is likely to be solved by one of the others, and this process goes on with every hour of study. Helping each other over difficulties is a very valuable feature of mutual help; but even of greater value is the influence it has in keeping up the interest in study.

The cheapening of literature, which has progressed so rapidly in the last quarter of a century, and has brought the best of books and the most valuable periodicals within the reach of wage earners, has done much to spread the taste for reading. The person who cannot spend an evening pleasantly reading a book is now an exception. The majority of books read by young people are neither of an instructive or an edifying character; but it often happens that by reading trashy, sensational stories, a person acquires a taste for reading of a more valuable character. The writer is a case in point. He was reared in a reading household and acquired a passion for reading stories before he was two years into his teens. For five years he devoured every novel or book of travel he could beg or borrow, and often walked ten miles to a library to obtain a book, after a hard day's work. One day a school fellow asked him if he had read "Dick's Christian Philosopher," a book then having a popular run. He had not, but no time was lost in borrowing it. Its contents turned his mind to more useful reading and he did not read another novel for years.

Reading books or periodicals that treat of the science of a man's business is a useful and instructive pastime and brings much incidental information; but

careful study is required to master principles and details. Reading engineering literature gives a person good general ideas about the subjects treated, but reading will not impress the exact knowledge necessary to pass an examination. An intelligent reader learns that steam is made by the boiling of water and that the steam is employed to drive pistons which transmit power to turn the driving wheels, but study is required to find out how the different operations are performed. It is the same throughout all lines of knowledge. Reading will impart information about outlines, but study must be exerted to master particulars.

A common and popular medium for imparting exact information concerning railway mechanism and engineering principles or particulars, is catechisms of various kinds, the most up-to-date specimen being our questions and answers. It is not enough that a student should read these to acquire the information imparted. If he merely reads them they will pass away from his memory within a few weeks. If he wishes to acquire the knowledge embraced in the answers he ought to have some one to catechise him periodically It is not necessary that he should answer in the exact words given in the paper. It is sufficient if he gives the correct answer in his own language. Trying to learn the exact words of answers is not a good practice. Any mutual union of persons to help each other in this sort of study will bring excellent results.

Operating a Canal by Electric Traction.

Americans have taken the lead of all other countries in the application of electric transmission of power, but in one department of industry they have permitted Belgian electricians to take the lead. This is in using electricity for the propulsion of canal boats and barges. The reason for this may be that the personages in charge of American canals are too much occupied securing State aid in the expense of operating to give any attention to improved methods of moving their barges.

While our canal men are devoting their energies to the increasing of appropriations, their Belgian compeers are operating by electricity a canal between Brussels and Charleroi, covering fifty miles. Triple wires run on poles above the towing-path, tractors running along the paths taking their current from them. Where, owing to the canals passing through cities or similar reasons, no towing path is available, electric launches are used.

The speed obtained is about double that of horse traction, and the cost of haulage is nearly 3 per cent. lower. But various regulations hamper the company, and prevent it from working so economically as it otherwise would. Thus tractors are not allowed to draw more than one barge at a time, though the advantage of taking a string of barges at once is obvious. The tow-paths, which are owned by the Government, are in a bad condition, and improvements are difficult to obtain. That such results can be obtained under these conditions is best proof of what might be done by an independent concern owning the canal line itself and establishing a straight service.

The Fireman in the White House.

The Brotherhood of Locomotive Firemen, by their representatives, at Chattanooga, Tenn., last month, admitted President Roosevelt to membership, by giving him the sign manual and the password of the order. At the conclusion of the secret session, in which this interesting ceremony was performed, an open meeting was held in the Auditorium, at which the newly elected brother spoke to a large and representative audience. President Roosevelt's speech to the firemen was a stirring address. The three cardinal virtues which he believes go to make up the manly type of citizenship—Honesty, Courage and Common Sense—were dwelt upon. He told his audience how General Sherman had said that if he was in another war he would endeavor to get as many railroad men as possible in his command. The old soldier valued these men, he said, because they have, on account of their profession, developed certain qualities which are essential in a soldier. They are accustomed to taking risk. They are familiar with danger and hardship, and they are used to acting on their own initiative, and they obey orders quickly.

Turning to the work done by the Brotherhood, he said: "I believe emphatically in organized labor; I believe in organizations of wage workers. Organization is one of the laws of our social and economic development at this time." The Brotherhood of Firemen now has about 44,000 members, and has paid into the general and beneficiary fund close upon one and a half million dollars. More than six millions and a half have been paid in since the starting of the insurance clause in the constitution, and more than six million and a half have been paid to disabled members and to their beneficiaries. Over 50 per cent. of the amount was paid on account of accidents. These acts, said the President, are a sufficient commentary upon the kind of profession which is yours. You face danger and death in time of peace as a soldier does in time of war. The two lessons taught by the organization is how much can be accomplished by organization, which means the helping of a man by teaching him how to help himself, and the indispensable means of keeping absolutely unimpaired the faculty of individual initiative. But while it teaches these things the organization of necessity must keep to the forefront the worth of the individual qualities of a man.

The speaker pointed out the supreme importance of character, when he said that the organization which he was addressing might have the same constitution it has now, the same laws and the same system, yet if composed of poor men the system would not save them. Reverting to the Spanish war, for an illustration, he said, I want to see each man have the best weapons, but if the man is a poor creature, no matter how good is his weapon, he will be beaten by a good man with a club.

As President Roosevelt is now a member of the Brotherhood of Locomotive Firemen, in good standing, might not an appropriate name for the next new lodge be the "White House Lodge," or "Roosevelt Lodge," or perhaps "Oyster Bay Lodge." The name of "Roughrider," was said by a fun maker at the convention to be applicable only to the conductors of the Chattanooga street railway lines.

Blows in Packing Rings.

The waste of steam and consequent loss of economy in fuel, due to worn or ill-fitting packing rings, is one of the most important items chargeable against an engine that has gained a record for heavy coal burning. There are no figures available to show these losses up accurately, and indeed such data would be of little value, since the effects of blowing rings are well enough understood, unless we except the fact that they would serve to remind us that a little more attention to maintenance of the cylinders of a locomotive might have the effect of reducing the charges on coal account. That this question is receiving some attention from the man on the right hand side, is quite evident from the letters we receive, asking for light on the results of inattention to the condition of packing rings, and requesting information as to how to test for leaks or blows. The following may be of interest to these men and to others as well:

A leak in the balance strip of an ordinary slide valve is detected by placing the valve in the center of its seat so that it laps the ports equally, and blocking the wheels. When steam is admitted to the steam chest a leak will allow it to pass by the strip and thence down through the leakage hole in top of valve into exhaust cavity and show at the nozzle. If a double nozzle is used the side the blow is on is apparent at once; if a single nozzle, it will require sharp sight to locate the side, but the sense of hearing will assist to this end.

Leaking cylinder packing rings are more easily determined, since steam will show at cylinder cocks at opposite end from admission, if there is leakage past the rings. A piston valve of either outside or inside admission type will show a blow due to leaking rings by placing the valve centrally on its seat and admitting steam, which will be in evidence at the nozzle and also at the cylinder cocks.

Blows in piston valve of two-cylinder compounds may be determined by placing the valve in the center of its travel as in previous cases, and the intercepting valve in position to work simple, which will admit steam of boiler pressure to the steam chest. This position allows a blow to show at the nozzle and cylinder cocks, as in the case of single expansion engines, for the reason that the high-pressure steam chest takes steam direct and has a separate exhaust opening.

In the case of tandem compounds, a blow in the rings of the high-pressure valve is found by the same method as that explained, for the simple engine having piston valves—except that the blow will be found only at the cylinder cocks, as the low-pressure valve controls the passage to exhaust nozzles. To test the low-pressure valve the engine is placed on center on the side to be tested, and the starting valve put in simple position. Steam admitted at this time will reach the low-pressure valve through the bypass valves of high-pressure cylinder, and any leak in rings will appear at the nozzle and also at the cylinder cocks.

The American Invaders.

The above is the name of a book by F. A. McKenzie, an English journalist, recently published in London. It has created a sensation among certain classes of the invaded, but the majority of British people who have read the book pooh-pooh its statements and assert that it gives warnings of dangers which are trifling or imaginary.

The American invaders are our manufacturers who are flooding the British markets. Twenty years ago very few vaders have made wonderful advances within the last five years, and in some lines of business threaten to drive British manufacturers out of their own home markets. Twenty years ago very few articles of American manufacture were to be found in Europe, except agricultural machinery. In engineering establishments, American-made milling machines began first to find favor, and as far back as 1889 we found in the Paris exhibition a variety of German imitations of our milling machines, but the imitators never succeeded in diminishing the demand for Brown & Sharpe and for Pratt & Whitney milling machines. The milling machine may be regarded as the entering wedge destined to open favor for all kinds of American-made special tools. To-day there are few labor-saving machines produced in the United States that are not used in European workshops, and in some lines of industry, such as shoe manufacturing and watch making, nothing but American-made machinery is employed. But even with American-made appliances, the British manufacturers are unable to produce the finished article so cheaply as it is made in our workshops, and in a variety of lines our manufacturers are "invading" the British market to such a serious extent that the native manufacturers see ruin staring them in the face. Among the lines in which we have routed the British manufacturers are: Iron and steel, boots and shoes, electric machinery of all kinds; telephones, photographic appliances; all forms of special machines, tools and labor-saving appliances, and an immense variety of other minor manufactured articles.

According to Mr. McKenzie, we have failed to worst the British manufacturer in the making of bicycles and of locomotives. The American bicycle makers failed in the British Isles because they used wooden wheel rims, which were not so well adapted for a humid climate as the steel rims used by British makers, and there were other defects which excited prejudice against the American-made wheel. In regard to locomotives, those which our makers have supplied to British railways suffer more from prejudice than from inherent defects. There is no question that they burn more coal than the British-built locomotives of similar capacity, but that is due to the valve motion which could easily be changed if there was a desire to make the engines work as economically as those of British make. All the American engines have about 1-4-in. less valve lap than the British engines, which in itself would account for the comparatively wasteful use of steam. They use more oil than the British locomotives, because the method of feeding the oil is different from that used on the latter and the drivers are strange to it.

The purpose of the book is to warn the British manufacturers of the danger that is threatening to take away their business. The warning will not be heeded, and so the invasion will continue to increase and the range of goods to multiply. Britain was so long the principal manufacturing country in the world that those who carry on the business nowadays are sunk in prejudiced self-complacency and imagine that no new means of defence is necessary to keep out invaders. The writer talked to a variety of British manufacturers about the statements made in the book, and all of them declared that they were wild exaggerations. One large manufacturer alleged that the author was a Yankee and that the whole story was a piece of Yankee boasting. The author is not an American, and how Americans would be interested in warning British manufacturers against the dangers threatening their business is a thing that none but an Englishman could suppose to be rational. The book ought to be read by every American manufacturer who is looking for a market abroad. It can be ordered through this office.

The Locomotive Magazine.

The proprietors of the *Locomotive Magazine*, now published monthly at 102A Charing Cross Road, London, have determined to convert their attractive magazine into a weekly. This important step has been taken after very careful consideration and the publishers are assured of receiving as much support for the higher-priced weekly as they have received for the modest monthly. The *Locomotive Magazine* has climbed into popularity to a great extent through the interesting pictures of locomotives and other railway appliances which have been its strong feature from the beginning. The president of the company, Mr. A. K. Bell, is a practical railway engineer, having been for years assistant to Mr. James Holden, locomotive superintendent of the Great Eastern Railway. He is also an expert photographer, a good linguist, and travels the wide world over, losing no opportunity to use his camera. That has enabled him to collect a wonderfully fine assortment of photographs illustrating railway equipment, railway scenes and interesting places in all parts of the globe. There is no fear of the publishers of the *Locomotive Magazine* getting short of illustrations that will be attractive to nearly all readers.

Curious Question of Spark Throwing.

A curious discussion has lately been heard in the Supreme Court of Virginia concerning a lawsuit about fire raising from sparks thrown from locomotive smokestacks. In giving an opinion a Judge used the words: "When, therefore, a large cinder does escape, it is evidence tending to prove that the spark arrester is not in good condition." To that the attorney defending the railroad company answered:

"I have recently had before me this question in a very important case, and went to Philadelphia to familiarize myself with this question of spark arresters in the Baldwin Locomotive Works, and have also been through the machine shops of the Norfolk & Western Railway. I have in my office cakes of cinder nearly as large as my hand, and which were found on the upper part of the wire netting. These cakes of cinder

were taken from a spark arrester in an absolutely perfect condition, the meshes of which were approximately the size mentioned in your opinion. It has bothered the mechanical department of the Norfolk & Western for many years to know how these could be formed. The solution of it has been discovered and is as follows: Cinders in small particles pass through the netting when the engine is steaming lightly or drifting, and there is not sufficient power to throw them out of the stack. They fall down upon the horizontal portion of the netting and fuse into large cakes, and when the exhaust is applied they are thrown out of the stack in chunks as large as one's thumb, or even larger. I wish that I could send you a specimen of this cinder. You could look at it and see that originally it was composed of small particles which have fused together. The evidence of all those familiar with the fact is that this occurrence in coking coal is inevitable, and no mechanical contrivance has yet been devised that will prevent it."

Our opinion has been asked about this case, but we cannot throw any new light upon it, as there is no one in this office who has had experience of spark matter fusing above the netting. If any of our readers can give notes of experience with such phenomena we shall be very glad to hear from them.

One Result of Per Diem.

The new state of affairs brought about by the per diem system is showing itself conspicuously in the Central West. It is stated that some of the trunk lines with headquarters in Chicago intend to scrap a great many of the old-fashioned 20-ton cars which have been returned to owners as a result of the day rental plan of car accounting. If these cars are scrapped, it is estimated that about 15,000 will go out of service. The marketable material which will be thus made available is probably about four tons of steel and wrought scrap from each car and three tons of cast and malleable iron scrap.

The trunk lines are reported to be willing to dispose of some of these 20-ton cars, with the understanding that they shall be used for local traffic only and not delivered to the trunk lines under any circumstances. While a few such cars will doubtless be absorbed by private car lines for local traffic, the majority of the smaller railroads throughout the country will be compelled to have larger and stronger cars in order to handle their traffic and be able to interchange without trouble.

Under the per diem rate and demurrage system, now in force, the larger railroads will be able to obtain far better and quicker service from rolling stock, which will very largely compensate for the loss of the 20-ton cars. Many of the important roads in the West have secured new equipment since last year's car famine, but with the "grain rush" coming on even those companies which have been looking ahead may find their resources severely taxed by the disappearance of so many 20-ton cars, desirable as that may be in the long run.

What Automobiles Are Doing With Superheated Steam.

There is a probability that the steam automobile may be the means of convincing locomotive users that great economy of heat may be secured by the use of highly superheated steam. The White automobile made in Cleveland, O., has a sort of flash boiler which delivers steam at about 700 degrees Fahr. In tests, and in ordinary every-day service, this machine has displayed extraordinary economy in the use of steam and there appears to be no difficulty experienced with the lubrication of valves and pistons. Another automobile having a flash boiler is the Serpollet, a French machine, which holds a fine record for speed and efficiency. A peculiarity of these high steam automobiles is that there is no objectionable escape of exhaust steam, the vapor passing out being nearly imperceptible.

Of course, a flash boiler would be impracticable for a locomotive, but superheating might be accomplished by means of the smoke box gases. This is a line of experiment worthy of the attention of Mr. M. N. Forney and other engineers who are laboring to improve the locomotive engine.

There is a great deal of humbug about the growing practice of railroad publications getting out congested numbers on every and any excuse, the enlargement being effected by big spread advertisements. These advertisements are secured by giving ridiculously low rates and by granting free space to favored parties. Cutting rates for one set of advertisers is stealing from those who pay schedule prices, for it swamps their advertisements among a mass of strange announcements, and leaves them to pay the same amount as they do when their advertisements have the prominence resulting from limited displays. For months before the mechanical conventions our agents were repeatedly requested to give free space as other two railroad papers were doing. If we give free pages to one advertiser at any time we will make it a free issue for all our patrons.

Our Book of Books, which is sent free on application, ought to be in the hands of every person who loves reading. The leaders of men are those who keep posted.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters in the waste basket.

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(156) J. T. S., Buffalo, N. Y., writes:

A friend claims that after the eccentric blades on one side of a locomotive are taken down, that you can move the valve on that side with the reverse lever. I claim that you cannot. Who is right? A.—You are right. The valve is moved according to the position of the eccentrics, and if they are disconnected the link will slide up and down on the link block without moving the valve when the engine is reversed.

(157) Apprentice Boiler Maker writes:

Can you give me a rule for finding the safe working pressure of a boiler that does not call for high mathematics? A.—Take a boiler 60 in. diameter, made of steel 1-2 in. thick, having a tensile strength of 60,000 pounds to the square inch. The factor of safety required is 4. That is, the strength must be four times the working pressure. We take 60,000 x 1-2 (thickness of plate) x 80 (strength of riveted joint), divided by 30, the radius of the boiler. When figured out that makes 800 pounds as the ultimate strength. That divided by 4, the factor of safety, gives 200 as the safe working pressure.

(158) A. X. G., Pittsburg, asks:

(1) When were paper car wheels first used and by whom were they invented? A.—We do not know. (2) Are they in general use now, and in what kind of service? A.—They are not in general use. When used they are employed in passenger service. (3) Are there any paper wheels made without the side plates, and having no reinforcement? A.—We have never heard of any being so made. (4) Are they being applied now? A.—Not to any extent; the larger roads do not use many of them. (5) What is claimed for them and what advantage have they over steel wheels? A.—They were intended to soften to some extent the jars incidental to rough track and hard service and to deaden noise.

(159) Apprentice Boiler Maker writes:

What are the proper tests that steel for a first-class boiler ought to go through? A.—The steel ought to be able to stand a pull of from 55,000 to 60,000 pounds to the square inch. That is called its tensile strength. Besides high tensile strength good boiler steel ought to have ductility that will enable the material to adjust itself to the strains caused by expansion and contraction. The tests for ductility turn on the elongation of the test piece in pulling it asunder and

in the reduction of area when breakage occurs. A common specification requires that the reduction of area at the point of fracture shall not be less than 56 per cent. Ductility is very important and is the reverse of brittleness. Sometimes chemical tests are required to guard against the presence of certain impurities, such as phosphorus and sulphur.

(160) M. R., Philadelphia, Pa., writes: We have a dispute about the condition of steam in boilers. Several of my friends say that the lower the pressure of steam the wetter it is, and that on that account using low steam is wasteful of heat. I say that the pressure has nothing to do with the wetness of steam. We have decided to have you settle the dispute. A.—The pressure does not affect the humidity of steam. Steam in contact with water, as in a boiler, contains only sufficient heat to keep it in the gaseous form no matter what the pressure may be. If any of the heat needed for vaporization is taken away part of the steam becomes water. Steam in the presence of water is called "saturated"; when it is passed into a dry vessel and more heat applied the steam then becomes "superheated," and can part with all the heat applied over and above that needed for vaporization before condensation takes place.

(161) W. A. S., Michigan City, Ind., asks:

(1) Suppose you were on a fast passenger run and were using the Stevens mechanical stoker and it broke down. how long would it take to disconnect and get ready for hand firing. A.—The feed chamber funnel and nozzle are supported upon a framework which is journaled upon a vertical standard and they are normally held in place by a link. By disconnecting the link this portion of the apparatus may be swung back out of the way so as to leave the door opening entirely free. The inventor says it takes about five seconds to do this. (2) With two fire doors, please explain how to arrange the Stevens automatic stoker A.—Two machines may be used where there are two furnace doors. Mr. Stevens claims that one machine will do, if there is room enough on the boiler head for a machine of the required capacity. Address F. A. Stevens, 1872 Folsom street, San Francisco, Cal., for further information.

(162) B. L. B., Middleport, O., writes: We have a tank which, when water is a few inches over half gone, the injectors will refuse to work. If hose is taken down and steam blown through and connection again made the injector will work fairly well. The injectors are Sellers No. 8½, in good condition, new tank valve, with more lift than formerly, and results as stated. Same injector on another engine worked all right. What is the trouble? A.—Several things may cause this. The tank valve may have been too small. A lift of one-fourth of the diameter of any valve gives an opening equal to the area of the valve, so that beyond that, additional lift does not add to the volume of water which can pass through. The trouble is more likely to be in the strainer, especially if of bell-shaped form. In such strainers the holes are frequently so few in number, especially near the bottom, that it is impossible for the water to get through fast enough, and the injector breaks. A good form of strainer may be made with flat bottom of ample area of holes to compensate for the friction produced in the stream by the interposition of the strainer. A well below the strainer of about one cubic foot volume is often a great assistance.

American Locomotive Company.

We have received a copy of the first annual report to the stockholders of the above company, and find it a remarkably attractive pamphlet. A brief history of the company is given with some particulars about the eight locomotive building works purchased by the company and operated under one management. During the first fiscal year the directors have expended $1,629,227.90 for additional land, new shop buildings, fixtures. machinery and other machine tools. The object of this was to increase the output, and it proved very successful, for the production was increased 25 per cent. Intimation is given that this policy will be continued with the view of still further increasing the output of the principal plants.

The advantages of the consolidation have, the report says, demonstrated:

"Greatly improved facilities, through the infusion of new capital, thereby reducing the direct as well as the indirect labor cost.

"The utilization of shop space at the different plants to the best possible advantage, thereby enabling the company to take orders for future delivery with better assurance of their prompt fulfilment.

"A minute, constant comparison of manufacturing processes, and the gradual unification of shop methods through the interchange of ideas.

"Some steps, at least, toward the standardization of locomotive design.

"The reduction of cost through the purchasing of material in larger quantities.

"A more intimate knowledge of the detailed costs of engine construction, through the adoption of a carefully classified uniform system of accounting."

The pamphlet contains seven fine wood engravings, illustrating the latest locomotives built by the company. Persons interested desiring a copy should apply to the Secretary American Locomotive Company, 25 Broad street, New York.

Where Will the Next Conventions Be Held?

We are in entire sympathy with the views expressed by Mr. John Tonge in our correspondence columns concerning the desirability of holding the next conventions of the railway mechanical associations in some western city, as a change from Saratoga. Personally we are quite indifferent about where the conventions are held, but we think it would only be fair toward the numerous western members, who cannot get away from their duties long enough to go to Saratoga, if the meetings were held within easy reach of their headquarters. Another reason why a change ought to be made is that many of the general officers are beginning to look with suspicion upon Saratoga being chosen so often, and we know that the difficulties in obtaining transportation to the conventions would not have been so great had they been held somewhere else.

The Master Mechanics' Standard Front End.

Lawyers and others frequently write to us asking for particulars about the most approved spark arresting appliances for locomotives. Information of a very exhaustive character on that subject is to be found in the Twentieth and Twenty-first Annual Reports of the American Railway Master Mechanics' Association. There is also a good illustrated article in Sinclair's Locomotive Engine Running. We are frequently asked for particulars of the Master Mechanics' Association standard front end, and we take this opportunity to say that there is no such standard. A variety of front ends have been illustrated in the proceedings of the association and their merits and shortcomings exhaustively discussed, but no agreement was reached about any particular form.

Confidence in Signals.

Commenting on the performance of one of Mr. F. W. Webb's engines on the London and Northwestern Railway, which in twenty years' service appeared to have been in the hands of only two crews, London *Engineering* says: "Evidently driving an express locomotive in all weathers does not involve the nervous strain that we are apt to suppose, else men could not continue to run backwards and forwards between two cities daily, for years. It argues absolute reliability in the signaling system, that this can be done, for were the driver not perfectly confident in the line being clear when the signal is down, he would be worn out with anxiety."

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

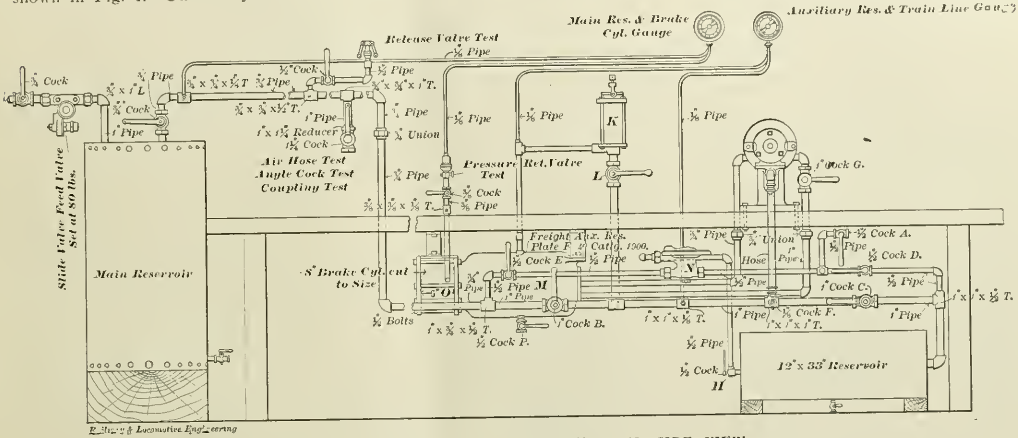
Shop Repairs and Tests of Triple Valves.

After receiving the necessary shop repairs, triple valves should undergo a thorough test upon a suitable rack as shown in Fig. 1. On it may be tested the "Freight," "Passenger" or "Pullman" triple valves.

The purpose of the weighted valve *K* is to maintain a certain difference in pressure between that in the train-pipe, and in the auxiliary reservoir. If the triple valve is sufficiently sensitive, its piston and slide valve will be forced to release position without the weighted valve being lifted, when the pressure in the train-pipe is slowly increased.

The weight to be used with each valve should never be other than as indicated on the weights themselves.

The *B-25* is the old 3-in. plain freight triple valve; *F-27*, the "Passenger" triple; *F-36*, the "Freight;" *G-24*, the new-style triple for tenders, known as the "Modified;" *F-25*, the "Driver Brake;" *F-46*, the "High Speed;" and *F-24*, the old-style plain triple formerly used on passenger equipment (it is now found in old tender equipments and occasionally in driver-brake equipment where small cylinders are used).



SHOP TEST RACK FOR REPAIRED TRIPLES.—SIDE VIEW.

A triple valve leaving the shop should receive the following tests aside from the general examination to condemn the graduating spring, emergency-valve rubber seat, check-valve spring, gaskets, strainer, etc.:

Test No. 1—Examination of fit of packing ring.

Test No. 2—For packing-ring leakage.

Test No. 3—Feed-groove test.

Test No. 4—For release.

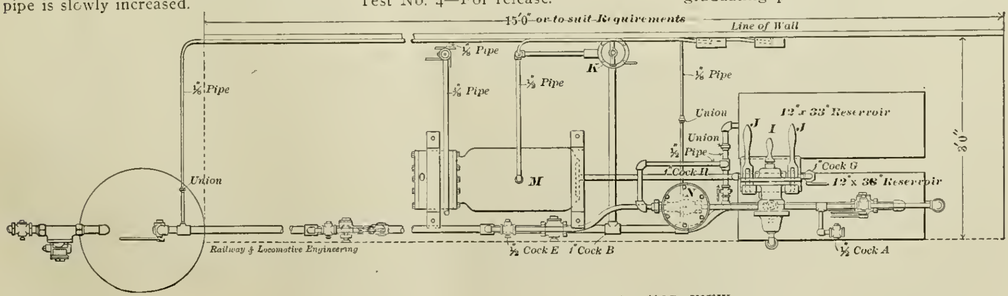
Test No. 5—For tightness of slide, emergency, and check valves, and general freedom from leaks of castings or gaskets.

TEST NO. 1.

The triple-piston packing ring must be examined and known to be fitted so that the ends come neatly together when in the cylinder, and, at the same time, be perfectly free when revolved in its groove. Entire freedom from dirt, and the lubrication of the triple-piston packing ring, the bush in which it works, and the slide valve only, with a small amount of high-grade oil, are important.

TEST NO. 2.

With all cocks closed excepting *F* and *H*, turn screw *I* to its extreme inward position; then close cock *F* and open cock *B* very slowly to avoid forcing the triple piston back with sufficient force to bend its stem when it strikes screw *I*, which screw is supposed to hold the triple piston midway between the service and graduating positions. The maintenance of 80 pounds pressure in the train-pipe should not result in leakage by the piston sufficient to give more than 15 pounds pressure in reservoir *M* in one minute. When this test is completed, close cock *B*, open cock *F*, bleed the air from reservoir *M*, and turn screw *I* to its outer position.



SHOP TEST RACK FOR REPAIRED TRIPLES.—TOP VIEW.

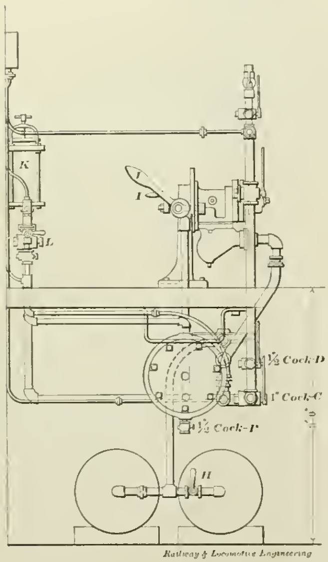
TEST NO. 3.

With the triple piston in release position, no air in the auxiliary reservoir, and 80 pounds in the trainpipe, the auxiliary should charge from 0 to 70 pounds, using an *F-36* triple, in from 60 to 85 seconds; an *F-27*, in from 28 to 45 seconds; and an *F-29*, in from 16 to 25 seconds.

To make test, close all cocks excepting *F* and *H*; opening cock *F* will exhaust all air from the train-pipe side of the triple piston; then close cock *F*, open cock *B*, and note the number of seconds necessary to charge reservoir *M* to 70 pounds. When fully charged, coat the exhaust port with soapsuds to be sure that no leakage exists when the slide valve is in release position.

TEST NO. 4.

With all cocks open excepting *E*, *A* and *F* (Fig 1), permit reservoir *M* to be

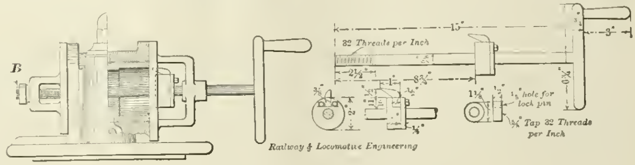


TRIPLE VALVE TESTING MACHINE—END VIEW.

charged to a pressure of 70 pounds; next close cock *B*, and, by means of cock *A*, slowly reduce the pressure, as shown by the train-pipe gauge hand, until it registers 60 pounds, at which time cock *A* should be gradually closed; coat the exhaust port with soapsuds to be sure the slide valve is tight in service position; now close cock *H*, and open cock *E*; under the conditions now existing the triple valve should release the air from brake cylinder *O* without valve *K* being lifted from its seat; if this valve should be forced from its seat, the movement denotes that the triple valve is not sufficiently sensitive, and the defect should be remedied. The rise in train-pipe pressure is retarded by controlling vale *N*, and any valve passing this test will be sure to release properly if placed at the end of a long air train.

TEST NO. 5.

The tightness of the slide valve in emergency position and the general freedom of the triple from leaks through castings or gaskets should be determined by painting the exhaust port and the triple with soapsuds when all cocks except *F* are closed. Passing these tests, the union should be uncoupled and the train-pipe connection of the triple covered with soapsuds to detect any back leakage by the emergency check valve or gaskets.



A HANDY TOOL FOR AIR PUMP WORK.

Air Brake Association Proceedings for 1902

The proceedings of the ninth annual Convention of the Air-Brake Association is just out of the press, coming a little late, but will be welcome nevertheless, inasmuch that they contain some very good and reliable data on modern air-brake practice. Especially good papers were submitted on round house air-brake repair work, frozen train pipes, their prevention and cure, and yard testing plants. These papers were thoroughly discussed by the members present and brought out a great deal of valuable information. We would especially recommend these proceedings to those who wish to be brought right up to date in what is doing in the air brake field.

Cold Weather Troubles.

As winter approaches we are forced to a remembrance that this season brings us more troubles than all others of the year combined; for it is winter that brings us flat wheels in greater abundance and troubles from frozen train pipes.

Properly designed brake leverage and the two application stop are good safeguards against the former, and a liberal length of pipe between pump and main reservoir will offset the latter.

CORRESPONDENCE.

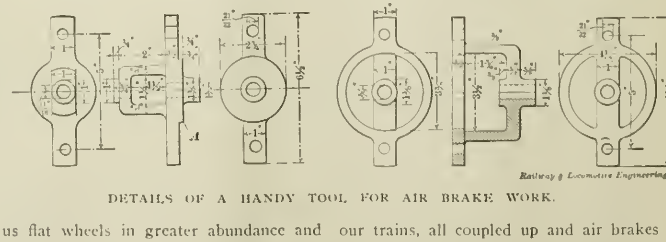
A Handy Tool.

I send you herewith a sketch of a boring tool for the main valve bushing for the 9 1-2-in. pump. When this bushing becomes worn so that its removal is necessary, this arrangement may be attached to the head and the bushing rebored, which, of course, will necessitate a new head for the main piston. This method of reboring the bushing and making a new head for the piston is better practice, I think, than bushing the bushing, because of the fact the bushing may become loose and steam blow by it, or if it is not securely fastened, it may turn so as to completely close both the steam and the exhaust ports.

The left support for the boring bar is arranged so that the projection A will fit the bushing as does the left cylinder head; i. e., a snug fit which holds it in a central position. The holes in the right support may be enough larger than the cap screws which hold both supports in position (but not shown in sketch), so that the tool may be shifted to suit the old bore.

The feed arrangement is a fine thread on the boring bar which works in a nut on the left support, and is held in position by a lock pin B when taking a cut. It is not necessary to add that this is a useful tool, etc., but we will let the reader judge for himself.

Chicago. W. W. UP DE GRAFF.



DETAILS OF A HANDY TOOL FOR AIR BRAKE WORK.

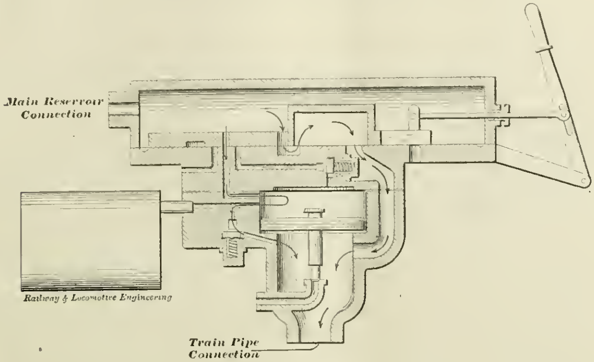
Long Air-Braked Freight Trains.

I would like to state that we are hauling as many as eighty-five freight cars in our trains, all coupled up and air brakes working on all of them. And this is with a nine and a half inch pump, too. I think this is a good record for long freight trains.

J. B. MURRAY,
Topeka, Kan. A., T. & S. F. Ry.

Recently Patented Brake Valve.

The brake valve illustrated in Figs. 1, 2 and 3 was recently patented by Mr. Paul Synnestoedt, the well-known air brake man and patent attorney formerly of Chicago, but now of Pittsburg, Pa. It is evidently designed to reclaim some of the old advantageous features of the C-7 brake valve as manufactured several years ago by the Westinghouse Air Brake Co. The main improved feature seems to be in the provision of two small check valves whereby air may be fed directly to the top of the piston in both full release and running position at the same time that pressure goes to the train pipe and under side of the equalizing piston.

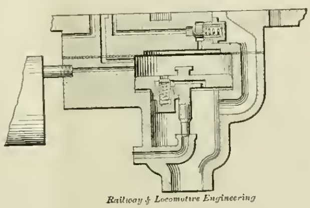


NEWLY PATENTED BRAKE VALVE—FULL RELEASE POSITION.

When the handle is placed in full release position, the air from the main reservoir passes through the port in the slide valve, down through the passageway past the check valve to the top side of the equalizing piston.

In the running position the pressure feeds by another port through the slide valve and to the top of the piston, thence around the piston, as shown by the direction arrows, to the under side of the equalizing piston. This feature of the brake valve is similar to that one of the C-7 valve where the main reservoir pressure passed through the rotary valve direct to the upper side of the equalizing piston, thence through the perforated equalizing piston, past the check valve on the underside to the train pipe. With the C-7 type the check valve was quite large and presented an area which, when gummed, would cause the check valve to stick tightly to its seat against the under side of the equalizing piston, thus closing off and preventing any feed of pressure from piston, past the check valve on the under side. The smaller check valve, as designed by Mr. Synnestoedt, has a much smaller area, and the trouble experienced with the C-7 would be largely reduced and almost entirely eliminated.

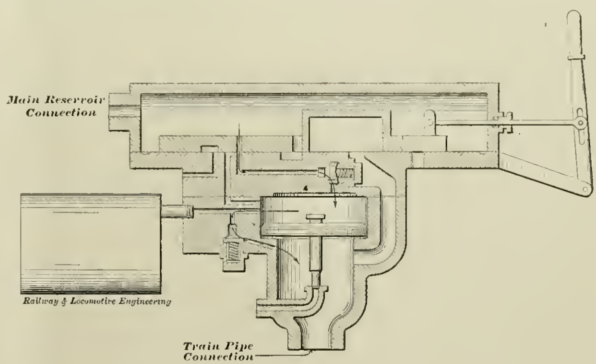
With this arrangement, there was in the C-7 valve, an entire absence of the flash at the train pipe exhaust when the handle was placed in full release position and a large volume of air permitted to pass from the main reservoir into the train pipe. This flash, which is now had with the G-6 valve would be entirely eliminated in a valve made as per the patent specifications of Mr. Synnestoedt. Of course the figures



NEWLY PATENTED BRAKE VALVE.

as shown in the patent paper are merely diagrammatic; that is, the drawing merely shows the principle involved, and not necessarily the actual construction of the valve as it would be when practically manufactured.

The drawing merely conveys the principle employed.



A NEWLY PATENTED BRAKE VALVE—RUNNING POSITION.

Are These Three the Only Causes?

Referring to article in July number about slid flat wheels due to journal friction and signed Mr. A. B. Crutchfield, I beg to state that I am not of the same opinion as he is. I think that there are only three causes for slid flat wheels, first, triple valve sticking, second, emergency application, third, hand brake set. Most wheels are slid pulling out of stations.

Mr. C. says: Slid flat wheels are caused by excessive friction and it is reasonable to suppose that in very cold weather the journal will not turn as freely in the brass as it will in warm weather. Now, if there is excessive friction, the wheel turns and cannot slide, because friction is caused by two objects rubbing against each other. Furthermore, if the friction is excessive, there will be probably a hot box and the oil in the journal box will become warm. So I think that the journal and journal-bearing have nothing at all to do with the question of slid flat wheels, but if there is very poor lubricant used for triple valves and cylinder, brakes may probably stick in cold weather.

Here in Mexico, where we, so to say, never have any cold weather, we get a slid flat wheel occasionally, but we generally find the cause of it lies in the triple valve. I think that the weight of a car will turn the wheels, after car is started, even if the weather be ever so cold.

LUIS MILLER,
Car Inspector, Ferrocarril Internacional, Mexico.

Monterey, Mex.

New Arrangement of Slack Adjusters.

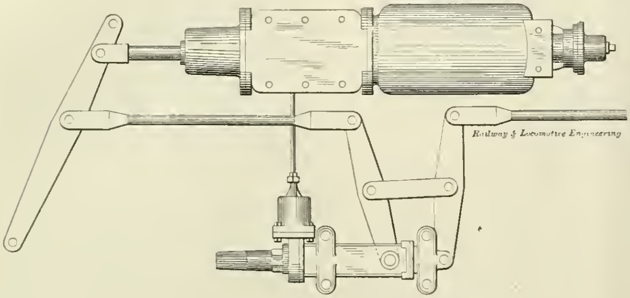
I am sending you some new arrangements of slack adjusters for engines and cars, which I believe will be interesting to your readers. Their application is new, and I think interesting.

AMOS JUDD.

Boston, Mass.

Emergency Test of Air Brakes.

It has long been my opinion that brakes should be tested by an emergency application as well as by service. Railroad managers were induced to equip their trains with continuous power brakes so that when an emergency arose they could be stopped quicker than by the use of hand brakes, and thereby reduce the number of accidents and make it safer for the traveler and their employees. Later they were induced for the same reason to adopt an improved triple valve, known as the quick-action, that their trains might be stopped still more quickly when an emergency arose. And now they are on the eve of advancing another step by adopting an improvement known as the "high speed brake," the use of which will again shorten the distance in which a train may be stopped when an emergency arises. These improvements have all been adopted in the interest of safety. Do we know, when a train starts out, that the benefit of these improvements can be realized, should occasion arise for an emergency stop?



SLACK ADJUSTER ON FREIGHT CAR BRAKES.

There is probably no steam road in the country to-day but what has strict rules which require the brakes to be tested before leaving a terminal, and after any change in the make-up of the train on the road, or hose separated for any cause. The reason why these tests are so important, and therefore the principal reason why they are made, is the great danger resulting from a stoppage in the train pipe, such as an anglecock being closed near the head end. In other words, the principal reason a test is made, is to prove that there is open communication from the engine to the rear car. To be sure, when the test is made, some roads require that the piston travel on all the cars be noted, but this is not the principal object of the test, and in my opinion, piston travel, leakage by packing leathers, and many other things should be noted when making the test in the yard with the yard plant, before the engine is attached, when there is time to make repairs found needed, so that when the road engine is attached at the terminal station the only thing necessary is to prove that there is open communication from the engine to the rear car. Do we know, from the test that is generally made, that the train pipe is wide open?

The operation of these improvements depends on a quick flow of the air through the train pipe, and this can only be obtained when it is wide open, that is, if an angle-cock is not wide open, or there is a partial stoppage of the hose or pipe, the air cannot move quickly enough to operate the quick action feature of the triple, on which the improvements depend. Therefore, a train with cars equipped with quick action triples cannot be stopped any quicker or in any shorter distance, than if it were equipped with plain automatic triples, should there be a partial stoppage of the train pipe at the forward end of the first car. And with a freight train, say of 50 cars, and the partial stoppage was in the train pipe on, say the 20th car, the danger resulting would be, in addition to the longer distance necessary to stop in, a severe shock to rear part of the train. In fact the result would be similar to that which occurs on a train of 50 cars with only 20 cars in use and an emergency application is made. This condition of things, I think, we are all familiar with and needs no explanation.

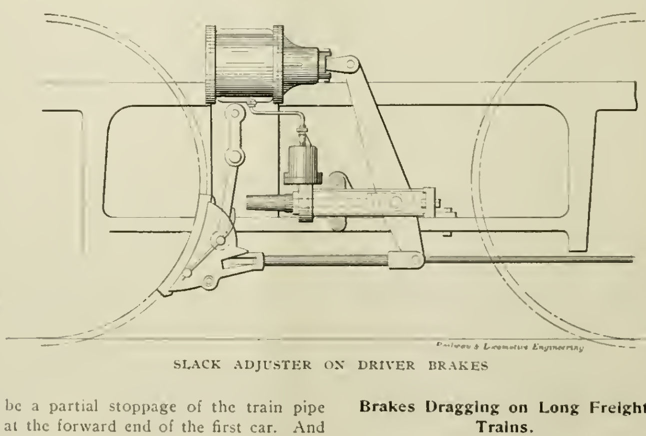
When the stoppage is such that the flow of air is restricted more than it is through the train line service exhaust of the engineer's valve, it may be detected when brakes are tested by a service application, but when it does not restrict it quite as much as the train line service exhaust, then it cannot be detected by a service application test. The obstruction, which by far is most likely to occur, is a partly closed angle-cock, that is open sufficient to obtain a service application, but not enough to permit quick action, or emergency application, back of this point.

Trainmen and inspectors should be required to fully open all angle-cocks. But why should we be satisfied that they have done so without proving it by a test any more than we should be satisfied that they have opened them at all? And so I would ask, should not brakes be tested by an emergency application as well as by a service application?

E. G. Desoe.

Gen'l A. B. Inspt., Boston & Albany R. R.
Springfield, Mass.

Don't fail to get a copy of the proceedings of the Air Brake Association for 1902. Its treatise on "Frozen Train Pipes, their Cause and Cure," is alone worth the price of the book. Price, 50 cents in paper, and 75 cents in leather binding, at this office.



SLACK ADJUSTER ON DRIVER BRAKES

Brakes Dragging on Long Freight Trains.

I would like to ask whether the 11-in. pump would not cause train pipe leaks to be neglected and become worse instead of better. J. E. Moorall.

[While the 11-inch has a greater capacity, its use would probably be attended with greater neglect of train pipe leakage. —Ed.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(193) B. R. O., New York city, asks:

What is the best location for a driving brake cylinder? A.—It must be a remote position away from the heat of the firebox, and the cylinder saddles also. The location largely depends upon the arrangement of the other parts on the engine.

(194) D. B. E., Springfield, O., asks:

Is it the right thing to put 1 1-4-in. train pipe on tenders? A.—While there is a little advantage to be had from a 1 1-4-in. train pipe when the tender is equipped with a quick action triple valve in emergency application, there is no advantage gained in the service application. Some roads have their tenders equipped with 1 1-4-in. train pipes, but we do not believe they are obtaining any material advantage from such a practice. Possibly there is a lesser tendency to give an emergency application in service operation on the light engine.

(195) E. R. B., Baltimore, Md., asks:

(1) What is the small nipple and nut on the back side of the air pump governor for? A.—This is a connection for a small pipe, whose duty is to carry away the steam condensation and air pressure accumulating in the chamber of the governor under the piston, due to leakage past the stem of the steam valve and air pressure above the piston past the packing ring. (2) What would happen if this pipe were stopped up? A.—The leakage of steam and air pressure would accumulate on the under side of the piston, and would not permit the air pressure coming on top of the piston to seat the steam valve.

(196) C. L. S., Kaslo, B. C., writes:

With Westinghouse air brake, turn up a retainer supposed to hold 15 pounds, then make a full service application and release. Then recharge and make a second full service application. Will you have any more pressure in the brake cylinder after the second application than the first? If so, how much? A.—Yes, there will be about three or four more pounds pressure in the brake cylinder after the second application, due to the fact that the brake cylinder does not have to be refilled at the start of the second application, and 15 pounds is there to start with.

(197) J. R. S., Boston, Mass., writes:

If the reason that the brake on a car holds better at a slow speed is on account of the rough places on the wheel and the brake shoe having time to get a deeper hold on each other, would it not increase the braking power of a car to apply longer and wider brake shoes? Of course the pressure per square inch would not be as great on the large shoe, but there would be more rough surface in contact with the wheel. A.—Brake shoes are usually made the full width of the wheel, and the full width of the shoe and the tread of the wheel is therefore obtained. It has been found in practice that the best length of brake shoe is about 13 or 14 in. After that the ends of the shoe stand away from the wheel and do not give the pressure that might be calculated according to the shoe area. In other words, the ends of the shoe do not bear as hard against the wheel as does the middle part. It can be seen, therefore, that the brake shoe as now used is about the proper size and dimensions to obtain best frictional results.

(198) D. B. E., Springfield, O., asks:

Why are some of the railroads putting quick-action triple valves on their tanks? A.—The quick-action triple valve properly belongs to the tender equipment, when the tender is equipped with high-speed brakes. Recently, however, several of the roads have been putting quick-action triple valves on their modern heavy tenders. Just what is to be gained from following such a practice is not exactly clear at the present time, unless it is their belief that the quick-action triple will give better service on these very heavy tenders than will the plain triple. It would seem that the insufficient braking power (if that is the cause) on these heavy tenders is due more to an undersized cylinder than to the triple valve itself. The quick-action triple valve on the tender will likely cause considerable trouble in making turn-table and ash-pit stops, unless it is supplied with a very heavy graduating spring, or the man handling the engine is very careful.

(199) W. A. W., Baltimore, Md., writes:

On our new engine there is a cock on the main reservoir pipe just below the brake valve. From this cock are two pipes, one connecing to the exhaust pipe fitting and the other connecting to the lower cap near the exhaust pipe fitting. There are also two small pipes running from this cock, one to air gauge and one to the pump governor. Could you give me any information about this arrangement? A.—The cock to which you refer on the new engine is doubtless the standard cut-out cock adopted a few years ago by the Pennsylvania Railroad Company for use when two engines are double-heading on a train. The arrangement permits of the second engineer reading the train line pressure and also admits of his applying the brake, should such become necessary, without cutting in any cocks in the train pipe. We have illustrated this device two or three times in the past, and we believe you will find the last illustration somewhere in your files of the past two years.

(200) J. F. McG., Corbin, Ky.

I notice that with New York triples that after a 5-, 10- or 20-pound reduction in service be made, then go to emergency, you get a discharge of air out of the emergency exhaust port of the triple. This is contrary to the principle of the brake. I have tried it on the road and in the air car, and this discharge came at every trial. The instructor said it was impossible, but it proved to be a fact that this discharge was obtained. We are led to believe, from your letter, that the train pipe in the case mentioned has been overcharged. In other words, that after a reduction has been made, the brake has been released, a heavy excess thrown into the train pipe, and a reduction made before the auxiliary reservoir has been charged, thus making a condition where the train pipe was charged higher than the auxiliary reservoir. In this event it would be possible to reduce 5, 10 or 20 pounds in a service position, and get the emergency action immediately following, as stated above. Possibly the packing rings in the triple were leaking past badly, and with a very light and gradual service reduction, air would be drawn from the train pipe and auxiliary reservoir without moving the triple pistons.

(201) W. W. L., Bakersfield, Cal., asks:

Why do the pistons on some freight cars come out regularly and continuously when the brake is set and others come out with little jerks, making seven or eight stops before the brake is finally set? A.—You will observe that the pistons come out more regularly and continuously when the train is short. This is due to the fact that the pressure in the train pipe is being reduced at the same rate that the auxiliary reservoir pressure is being reduced and sent into the brake cylinder. This permits the graduating port in the slide valve to be kept open continuously, thereby supplying a continuous flow of pressure into the brake cylinder. Hence the gradual movement of the piston. On long trains the train pipe pressure is not reduced in service application as rapidly as the graduating port in the triple valves reduces the auxiliary reservoir pressure and passes it to the brake cylinder. This causes the triple valve to close its graduating port after the auxiliary reservoir has given a supply to its cylinder, until such time as the pressure in the train pipe is again slightly below that in the auxiliary reservoir, when the triple will open up again and pass pressure from the auxiliary into the brake cylinder. Hence the jerky operation. Again, poorly lubricated packing leathers in the brake cylinders may cause the pistons to travel out in a jerky manner; but the difference in action on the long and short trains is primarily due to the first explanation.

The Perfection Fuel Economizer and Smoke Consumer.

It has been said that the best way to consume smoke is not to make any, but the Perfection Fuel Economizer people do not believe that theory is capable of being put in practice. Their position may probably be more correctly stated by saying, "You make the smoke, we do the rest." At the same time the inventors of this smoke consumer are fully alive to the fact that little or no smoke issuing from the smoke stack may, under certain circumstances, mean very uneconomical burning of coal. When a shovelful of coal is thrown into the firebox of an engine, a certain amount of very fine dust is caught up in the strong draught and is hurried through the tubes and out of the stack in the form of unburned coal dust. That is not smoke, however, but large or small, it constitutes a loss. The shovelful of coal on reaching the bed of burning fuel on the grate, gives off carbureted hydrogen gas. This is the hydrogen in the coal which is combined with carbon. The igniting temperature being present, the oxygen of the air begins to combine with it, but the oxygen, with a curious preference, will combine with the hydrogen first, and liberate the carbon; this latter must now be combined with oxygen or it will go out through the stack unconsumed, in the form we call smoke. If sufficient oxygen be present to fully burn this liberated carbon, the whole of the carbureted hydrogen gas will have been accounted for. If, having burned the hydrogen, only enough oxygen is left to partly burn the carbon, then a gas called carbon mon-oxide, CO will be formed, which, though it does not produce smoke, represents very little economy. So much for the carbureted hydrogen.

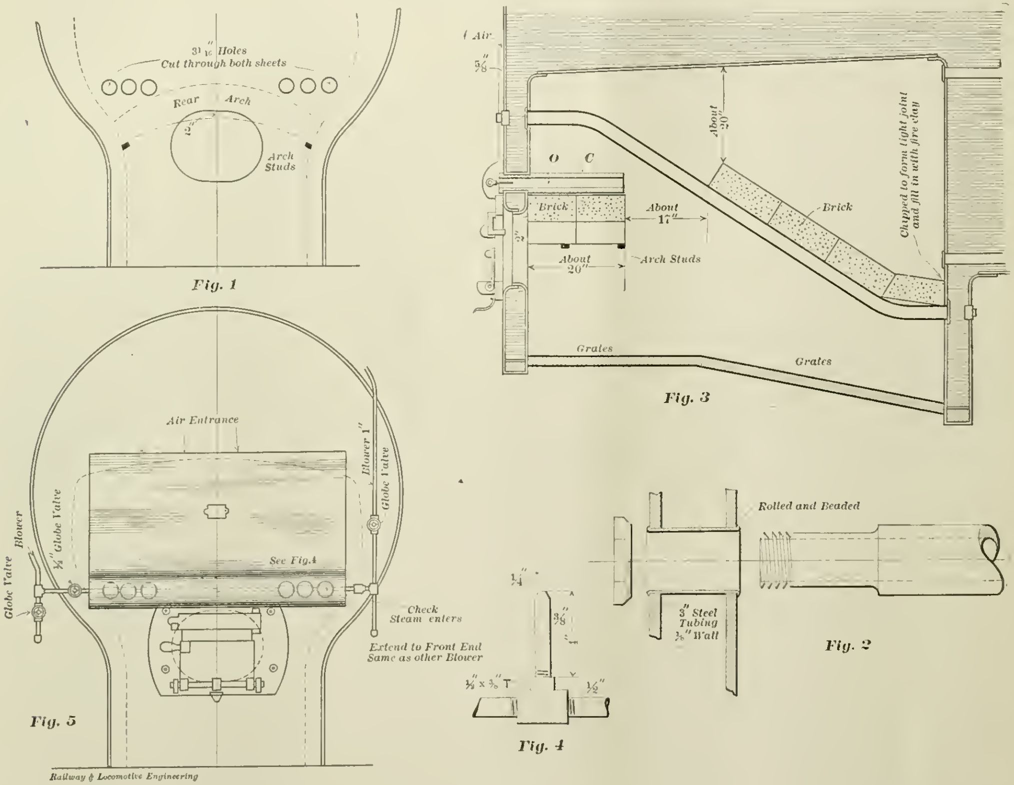


Fig. 1

Fig. 3

Fig. 2

Fig. 4

Fig. 5

What is left after the volatile gas has been distilled off, is coke, and this has yet to be consumed. If sufficient oxygen is present, with the required temperature, the combination is complete, and carbon dioxide, CO_2 is formed and no smoke appears. If an insufficient supply of oxygen reaches the coke, the smokeless but uneconomical carbon mon-oxide is formed, and CO will have to be still further burned to CO_2 in order to get the maximum heat units from the coal.

All these contingencies are provided for by the apparatus known as the Perfection Fuel Economizer and Smoke Consumer. A brick arch just above the fire door extends horizontally into the firebox about 20 in. A space of about 17 in. is left, and a long sloping brick arch overshadows the rest of the grate and terminates at the flue sheet just below the level of the tubes. The products of combustion, coal dust, smoke, unconsumed gas, all have to pass through an opening, the area of which, 17 in. wide, and as long as the firebox is wide. On top of the short, level arch at the back of the box are a number of air tubes, made of material capable of resisting heat. These draw their supply of air from outside the back sheet, but the air, as it passes to these tubes, is made to flow down along the hot boiler-head between it and a sheet metal wall. A small steam jet may be used, if desired to stimulate the draught. Air at a temperature, said to be about 1,700 degrees F., is thus supplied to the firebox at the 17-in. opening between the brick arches, where everything rising from the grates must pass up and intermingle. This contracted opening forces the coal dust to encounter its igniting temperature before it reaches the flues, uncompleted combustion is completed here, on account of the high temperature maintained by flame and gas rushing through with the constant

supply of very hot air. The products of combustion then pass out of the stack, not only showing no smoke, but what is of more importance, having given up all their available heat units to the water in the boiler. This, when attained, means maximum economy. The New York Central Railroad has tested this device, and is so satisfied that it has passed the experimental stage, that 25 Atlantic-type engines are being equipped with it. A saving of one ton of coal on a run with one of the heavy trains between New York and Albany is credited to this economizer. We are informed that the Maine Central has ordered four engines to be equipped, the New Haven is giving this consumer some attention, and the Pennsylvania has become interested to the extent of making an investigation of its operations. About twenty-five railroads are looking into the merits of this device.

The device is owned and controlled by Coffin-Megeath Supply Company, Franklin, Pa. Messrs. S. W. Symonds, formerly master mechanic at Mott Haven, and J. S. Fulton, formerly road foreman of engines on the New York Central Railroad, are the inventors. Practical men are here dealing with a railway and locomotive engineering problem.

New World Methods.

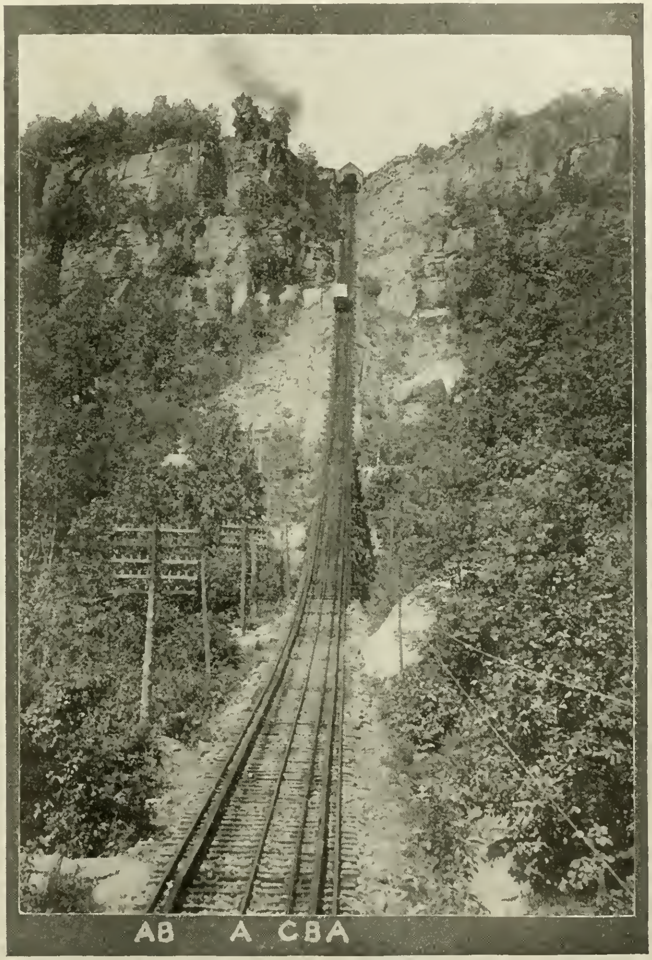
The success of American production, chiefly in the line of machinery, has at last startled Europe, and the United States is at present receiving some important visitors, such as the Count von Tiele Winckler, a noted Berlin financier, and Colonel Yorke, chief inspecting officer of the British Board of Trade, whose mission is to learn the secret of her being able, with her dear labor, to compete with the cheaper labor of Europe. Had not the element of artificially expensive labor entered into the problem, these investigations would have had to be made long ago. Methods of production and machine-made articles is probably the answer these gentlemen will take back with them.

When the Sirdar of Egypt wanted a bridge to carry his railway over the Atbara to get to Khartoum he applied to British bridge builders, any of whom could furnish him with a bridge according to specification in a year or two. The United States bridge builders, when applied to, only wanted to know how much bridge he wanted and they had a bridge ready to ship. In the one country each bridge was a separate engineering work; the other, to speak roughly, kept ready-made bridges in the piece, and cut them off to order. In doing business on this scale the United States manufacturers are able to put the highest order of intelligence at work, to tempt which from Europe or anywhere, money is no object.—Montreal *Witness*.

The Environs of Chattanooga.

LOOKOUT MOUNTAIN INCLINE RAILWAY.

Lookout Mountain is, of course, one of the most interesting places of resort in the neighborhood of historic Chattanooga, and the way to get to the summit is at once curious and interesting. There is, of course, a good mountain road for teams, but the inclined railway up to the summit always interests the visitor. Our illustration is from a photograph taken just about where the carriage road crosses the incline on a high bridge. The railroad has two tracks, although only three rails appear, marked AAA, the center rail being used by both cars, the flanges of whose wheels, contrary to usual practice, run along the outside of each rail. The longitudinal wooden stringers are shown at BB, while the cable attached to the car already far down the slope, below our viewpoint, is marked C. Each car is made with seats raised one above the other, like those in a theater, so that when on the incline each passenger sits approximately on the level. Both cars are raised and lowered by cable; in fact, the cars are really at the ends of a double cable, and each car helps to balance the other, much as elevator and counterpoise do in a high building. The double cable passes round a wheel or drum in the power house at the summit, and as one car is drawn up, the other is let down. The speed is always slow, and when it is necessary to stop one car the other must also halt. From this form



INCLINE RAILWAY—LOOKOUT MOUNTAIN, TENN

of construction and operation it is obvious that the meeting point for the cars, as one goes up and the other comes down, is at a certain point just half way up the incline. Above and below that particular point the cars cannot possibly meet. Here there is a switch and the line widens out into two tracks with four rails; this slight deviation in the track does not effect the line of pull of the cable to any noticeable extent. It is, of course, only at the switch that the four rails are necessary. The flanges of the wheels run on the outer side of the rails, and the frog lies on the center line at the point, where it branches out into the two rails required at the switch. This arrangement has the effect of making the outer rail, for each car, continuous all the way, and with flange of wheel on outer side, it is the continuous rail which deflects the car away from the center line of pull at the

RAIDERS' MEMORIAL, CHATTANOOGA.

switch, both in going up and coming down. There is therefore less risk of the flange taking the wrong path in passing through the frogs. In the upper half of this incline the grade is 67 ft. in 100 ft., and the top of Lookout Mountain is 1,700 ft. above the city, and from the top a fine view may be had.

The arrangement of the wooden guard stringers is interesting. If a derailed car was going down and got off toward the left side of the illustration it could only proceed out of line until the wheels belonging to the middle rail caught the left stringer, and though the car might tip over at a considerable angle, it would probably be held by the cable. If it got off the track so as to move toward the right side of the illustration the guard stringer would at once engage the outer wheels and prevent the car from moving over and cutting or fouling the cable of the car below it. If derailed cars on either track were going up the pull of the cable would tend to keep them on a fairly straight road, and the wooden guard stringer would protect the cable of the other car.

THE NATIONAL CEMETERY.

This cemetery contains 75 1-2 acres of beautifully kept ground, in which rest the bodies of upward of 13,078 soldiers, out of which 4,969 are "unknown." Perhaps the most interesting monument in the cemetery to railroad men is that raised by the State of Ohio to the memory of the "Raiders." Upon a suitable pedestal is placed a bronze replica of a locomotive, probably about one-eighth the full size. This engine was No. 3, and belonged to the Western & Atlantic Railway. It was named "The General." The story of the Raiders, briefly told, is that Captain James J. Andrews, U. S. A., and nineteen volunteers captured "The General" at Big Shanty, April 20, 1862, while train crew and passengers were at breakfast. The object was to destroy bridges on the Western & Atlantic Railroad, and so break an important southern line of communication. Conductor Fuller, Engineer Jeff. Cain and Anthony Murphy, foreman of the W. & A. shops, pursued the raiders on foot for some distance. Finding a handcar, they continued the pursuit in better style. Later they came upon an engine, the "Yonah," at Etowah, and the chase became so hot that the raiders were not able to stop long enough to do any damage. "The General" was finally abandoned on account of lack of fuel and the closeness of the pursuers. Andrews and several of his comrades were afterward executed.

The engine itself stands in the Southern Railway passenger station at Chattanooga. She is a Rogers engine of the ordinary eight-wheel type, with cylinders 14 x 22 in. "The General" was in war times a wood burner, but being subsequently used in regular road service, coal was burned and the smokestack was changed. It was while in burning coal that the model was made for the monument, but when the engine was placed in the passenger station as a war veteran, the smokestack was changed to the original pattern. The engine has no guide yoke, as we know it, the ends of the guide bars being carried by a short bracket, which is bolted to the frame. Although this engine is now a relic of the past, there is one thing which is strangely modern to the eye of the motive power employee of the present day—the forward side rod, brass oil cup on the left side had been stolen.

Locomotive Building in the United States.

The Census Office has completed a special report on the building of locomotives in this country during the year 1900. In this year there were twenty-eight establishments, the sole or chief product of which was locomotives. At these works 2,774 locomotives of all classes were built, with an aggregate value of $27,121,063. In addition, 272 locomotives, valued at $3,276,393, were constructed at 26 railroad shops, making a total of 3,046 locomotives, valued at $30,397,456, built in 54 establishments during 1900.

Our locomotives owe much of their excellence and cheapness to the efficient machines, tools and processes used in their manufacture. The boiler is built in two sections, entirely by power riveting, practically the only rivets set by hand being those in the single ring where the halves are united. Instead of finishing connecting and coupling rods singly, several are clamped together and planed or milled simultaneously, with an expenditure of practically the same time and labor that would be required to finish one. Similarly and with even more marked economy, four or six frames are planed and slotted as one piece. This same principle of multiple work is applied in the manufacture of many of the minor parts. The assembling of the finished parts and the erection of the complete locomotive are characterized by the same time and labor saving methods that are applied in the making of the component parts. Practically everything is finished and fitted before being transferred to the erecting floor, so that putting the parts together is a rapid operation.

The Whole Thing Turns on Graphite.

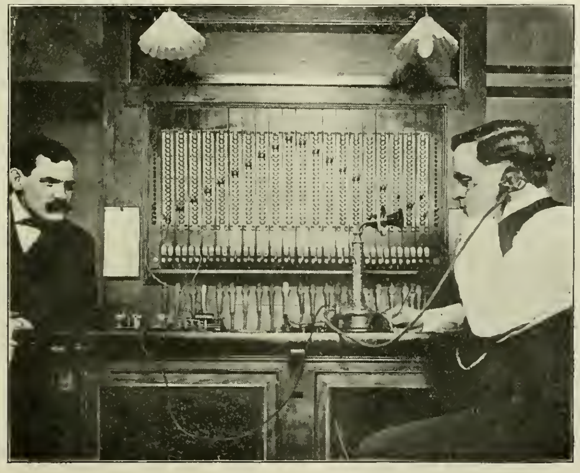
A foreman on one of our leading railways writes to *Graphite* to say that recently he had had some trouble with a 60-ft. turn table. He says the weight of the engine and table on the center point is about 200,000 pounds, the bearing is an 8-in. steel pivot, running on an 8-in. loose bell metal disc. This table, with an engine properly balanced on it, took six men to turn it, after having the center pivot cleaned and oiled with sperm oil and beef tallow. The experiment was tried of lubricating it with graphite, which proved very successful. Some of Dixon's Waterproof Grease was reduced by the addition of sperm oil to the consistency of butter and put in the pivot socket. One of the heaviest engines in the shop was then turned in one minute by two men.

A certain newly appointed general manager once made himself temporarily famous by discharging a number of old hands as soon as he "took hold." A stranger accosted the throttle-puller of an outgoing passenger train with an inquiry concerning the G. M. "Is there a man named Blank on your road?" "Yes," replied the engineman, "he's on the road all right, and has been for some time, but he's 'firing' out of Bluetown now." This kind of firing may not make much smoke, but it certainly produces some heat.

"Railroad Telephone Service."

BY WALDON FAWCETT.

The introduction of the telephone in connection with railroad service has been made simultaneously on several of the great transportation systems of America, and, singularly enough, the utilization of this means of communication has assumed several different forms, each in its way, of distinct value, either as adding to the convenience of the traveling public or promoting safety in the operation of the railway lines. Probably the most interesting employment of the telephone in this new field is found in its use in general train dispatching, a class of work in which its value has been proved by installations on the Illinois Central, the Lake Shore and other railroad systems.



AT THE TELEPHONE BOARD.

KEEPS TRAIN CONSTANTLY IN TOUCH WITH HEADQUARTERS.

The safety telephone system as installed on these and other railroads permits the engineer of any train to stop anywhere on the main line of the railroad and instantly establish telephonic communication with the nearest station or a more distant point for the purpose of securing orders, or in the case of an accident to summon assistance. The possibilities of the telephone as an adjunct of railroad administration must be readily apparent to any person at all familiar with present-day railroad practice.

Under the old plan when a train encountered a washout or found its progress blocked by a serious obstacle of any kind, ten or twenty miles from a station, the only course open to the operatives was to send a flagman to the nearest station to telegraph for help, a proceeding which was likely to entail a delay of from three to five hours and seriously discommode traffic on that entire section of the line. Under the new plan the engineer has only to connect the wire attached to the telephone transmitter in the locomotive cab to the line of the main telephone system attached to the telegraph poles alongside the track, and within a few minutes at the outside he can call up any station desired. Under this new plan it has frequently been proved possible to have a fully equipped wrecking train en route to clear the track within thirty minutes after the occurrence of a wreck. The telephone system has another advantage in that in the event of a serious wreck it enables the conductor to report at length to division headquarters, answering questions and thereby giving the administrative officials a much clearer idea of actual conditions at the scene of trouble than would be possible were it necessary to depend on the telegraph.

IMPROVEMENTS WILL PROVIDE WRITTEN RECORD OF MESSAGES.

The only objection which has been advanced to the use of the telephone in train dispatching is found in the fact that it does not provide any written record of the orders given or received, but it is probable that even this difficulty will ere long be obviated, for inventors have all but perfected for railroad use a telephone which not only conveys the message to the ear, but by means of a code records all that passes over the line. Moreover, it is to be borne in mind that the most progressive railroads are doing everything possible to minimize the responsibility of the train dispatcher. The responsibility of the engineer and conductor is being increased proportionately, and nothing could be more conducive to this than the introduction of telephonic train dispatching.

USED ON ROYAL TRAIN ON CANADIAN PACIFIC.

However, this by no means exhausts the lately developed possibilities of the telephone in connection with train service. When the Duke of Cornwall and York recently passed through Canada the officials of the Canadian Pacific Railway anxious to do everything possible to minister to his comfort, installed on the special train a telephone service which enabled the members of the royal party to communicate from car to car. This idea has since been elaborated by other railroads and on the latest trains as now equipped the engineer in the cab is brought within talking distance of the conductor at all times, and the brakeman at the rear of the train may at any time call up the engineer so that the old system of signaling by means of a rope is entirely done away with.

The telephone instrument used in this class of train service differs somewhat radically from the familiar style. Obviously the greatest difficulty to be overcome in telephoning from car to car on a moving train is constituted by the vibration which drowns the speaker's voice. A solution of the problem has been accomplished, however, by the introduction of a combined transmitter and receiver which can be hung on the wall of the car when not in use and taken down bodily when required for purposes of conversation. It has been found that if the telephone is held in the hand there is little if any more noise from vibration than in an ordinary building.

CONNECTS PARLOR CARS WITH OUTSIDE WORLD.

Still another new and emphatically up-to-date use for the telephone has been discovered on the Chicago & Northwestern and other railway systems. On these lines the parlor and sleeping cars of all through trains are equipped with telephones, and the business man reaching the train a few minutes before the time of departure finds that he has opportunity to converse with persons at his home or office. A messenger boy is in charge of each telephone terminal on board a train, and if notified in advance he has connections made and a line open for the use of the busy man of affairs the minute he steps aboard, so that the latter may continue to transact business up to the very moment the train pulls out. Likewise at the station in every large city where the train stops telephone connection is established not only with the local exchange, but with the long-distance system as well, and thus a

business man may literally keep in touch with his affairs while traversing the continent.

PROMOTES SAFETY.

The tendency to remove a major part of the old responsibility from the shoulders of the train dispatchers and distribute it between conductors, engineers and automatic devices as well as the proposed extensive use of the telephone, serves to direct attention to other electrical devices designed to play a part in this new order of things. The most important of these is the Miller electrical system, which is now being installed on fifty miles of the track of the Chicago & Eastern Illinois Railroad between Chicago and Momence.

This remarkable invention will give the engineer of a train moving at a speed of a mile a minute absolute knowledge as to whether there is any train either ahead or behind endangering the safety of his own train. More than that, this wonderful mechanical signaler apprises the engineer if a rail is broken, a switch misplaced, a signal set wrong, or if any other unexpected contingency has arisen. All this is accomplished by means of an intricate system of wires and batteries which become operative three-quarters of a mile distant from any obstruction. The contact causes the illumination in the cab and directly in front of the engineer of a white, green or red incandescent bulb, as the case may be. The white light indicates a clear track; the green light signals that the train may proceed only with caution, and the red glow calls for a dead stoppage of the train at once. It is claimed that with this device in operation it will be possible for express trains to maintain full speed while passing through congested track districts—heretofore one of the most serious causes of delay to through passenger trains.

Great development has also taken place recently in the electric headlight. Certain western systems are now using an electric headlight, the gleam of which may be seen fully five miles away on a straight track. The light is not only projected a long distance in advance of the locomotive, but a shaft of light rises in the air perpendicularly to a height of 100 feet. This latter light is designed to serve as a preventative of collisions by warning an engineer of the approach of another train.

TELEPHONE IN LOCOMOTIVE CAB.

The Cast Steel Wheel Coming.

Ground was broken last month for new works to be erected at Butler, Pa., for the purpose of rolling solid steel car wheels. The works will be under the control of that veteran steel engineer, Mr. Charles T. Schoen, who was the pioneer in the building of steel cars that competed successfully with the wooden car and is steadily pushing it out of service for carrying heavy freight. Tests of the machinery will be made at the works of the Bethlehem Steel Co., where it is being built, before it will be set up, in the new Butler plant. The contracts for the buildings for the works have not yet been let, but will be awarded within a short time. Mr. Schoen says that the plant will begin business with a daily capacity of 400 car wheels, which, he explains, will show a tensile strength of 85,000 pounds, their durability equaling that of the rolled steel tire locomotive wheel, which make a mileage of about 30,000 for every 1-16 inch of wear. That basis would insure about one million miles for the steel wheel. The guarantee required by the M. C. B. Association from makers of cast iron wheels is that they shall run 60,000 miles.

Using Discarded Box Cars.

Owing to extraordinarily heavy traffic, the Illinois Central is badly in need of equipment for freight. Unable to get cars which have been ordered, the management has taken a novel method of increasing its freight shipments.

Orders have been issued to assemble every discarded box car on the entire system and patch them up for emergency business. Hundreds of such cars are fitted up as houses and dot the tracks of the Illinois Central from Chicago to New Orleans and from Omaha to Chicago.

Before depriving the working gangs of house and home the management distributed tents to replace the box cars, and the tents will be used until new homes can be rigged up.

A novel method is also being employed to replace the box-car homes taken away from the workmen. All the discarded flat cars on the entire system have been assembled in the various shops and are being reconstructed into houses which resemble the box-car house.

When boarded up and "sided" the flat car makes a more commodious home than the box car. The substitution is costing the company considerable money, but it will add materially to the carrying capacity.—*N. Y. Commercial.*

The Safety Car Heating & Lighting Co., 160 Broadway, New York, have issued a very handsome catalogue illustrating new forms of Pintsch Gas and combination gas and electric light lamps for railroad cars. The engravings are so beautifully done that it is a source of real pleasure to one of artistic tastes to look at the pictures.

In the Cleveland *Press*, of September 20, there is an advertisement calling for railroad men to send 25 cents for examination blank to find out if they are suitable for employment. The thing is a fraud upon the face of it. We have directed the attention of the Post Office authorities to the matter, but meanwhile we advise railroad men not to lose their money in this transparent swindle.

On September 7, engine 1102, one of the newest type, belonging to the Lehigh Valley, pulled a train of 104 loaded cars weighing 4,013 tons, from Sayre to Weldon, a distance of 82.4 miles, without assistance. This was one of the heaviest trains ever handled.

Of Personal Interest.

Mr. N. L. Rand has been appointed master mechanic on the Intercolonial Railway of Canada with headquarters at Moncton, N. B.

Mr. W. R. Wright has been appointed superintendent of terminals of the St. Louis, Iron Mountain and Southern Railway, at Little Rock, Ark.

Mr. W. S. Lawless has been appointed master mechanic of the St. Louis and North Arkansas Railroad, with headquarters at Eureka Springs, Ark.

Wm. Apps, formerly master car builder of the Canadian Pacific Railway, has accepted a similar position on the Algoma Central & Hudson's Bay Railway.

Mr. W. H. Williams, assistant secretary of the Baltimore & Ohio Railroad Company, has been appointed an assistant to General Manager G. L. Potter.

Mr. W. B. Casey has been appointed chief engineer of the Chicago, Lake Shore and Eastern, and the Elgin, Joliet and Eastern, with headquarters at Joliet, Ill.

Mr. R. A. Billingham has been appointed general master mechanic of the Pittsburg, Shawmut and Northern Railroad, with headquarters at St. Marys, Pa.

Mr. G. L. Morris has been appointed general superintendent and auditor of the Little Rock and Hot Springs Railroad at Hot Springs, Ark., vice Mr. H. E. Martin, resigned.

Mr. F. C. Smith has been appointed general superintendent of the Colorado Springs and Cripple Creek District Railway with headquarters at Colorado Springs, Col.

Mr. T. N. Gilmore has been appointed master mechanic of the Terminal Railroad Association of St. Louis, at St. Louis, Mo., vice Mr. W. C. Wilson, assigned to other duties.

Mr. J. R. Gould has resigned as general foreman of the Chesapeake and Ohio Railway at Huntington, W. Va., to accept the position of assistant master mechanic of the same road at Clifton Forge, Va.

Mr. B. E. Greenwood, formerly general foreman of the Lake Shore & Michigan Southern, at Collinwood, Ohio, has accepted a similar position with the Seaboard Air Line Railway at Portsmouth, Va.

Mr. F. P. Hickey has been appointed master mechanic of the first, second and third divisions of the Seaboard Air Line, with headquarters at Raleigh, N. C. He was formerly master mechanic at Portsmouth, Va.

Mr. W. F. Kersel has been appointed assistant mechanical engineer of the Pennsylvania Railroad at Altoona, Pa., to succeed Mr. A. W. Gibbs, resigned. Mr. Keisel was formerly assistant engineer at the same place.

Mr. R. Peard, superintendent of the Canadian Pacific at Brandon, Man., has been transferred to a similar position at Souris, Man. Mr. J. G. Taylor will take his place at Brandon, with the title of acting superintendent.

Mr. D. W. Jackson, who has been for several years round house foreman of the Delaware, Lackawanna and Western at Hallstead, Pa., has been appointed master mechanic on the same road at Elmira, succeeding Mr. Lonergan, superannuated.

Mr. E. P. Mobley, roadmaster of the eastern half of the eastern division of the Chicago Great Western Railway, has been appointed division engineer of the southwest division, headquarters Des Moines, Iowa, to succeed Mr. W. B. Causey, resigned.

Mr. John A. Dodson has been appointed assistant to the general manager of the Southern Railway, with headquarters at Washington, D. C., vice Mr. C. S. McManus, who will take Mr. Dodson's former position as general superintendent of the same road at Chattanooga, Tenn.

Mr. John McGie, master mechanic of the Central Railroad of New Jersey, has resigned to accept the position of general master mechanic of the Choctaw, Oklahoma and Gulf Railroad. Mr. McGie was formerly general master mechanic of the Montana Central Railway.

Mr. A. S. Grant, master mechanic of the St. Louis, Iron Mountain and Southern Railway at Baring Cross, Ark., has been transferred to the same position at Sedalia, Mo., to succeed Mr. A. Harrity, who will take the position vacated by Mr. Grant. Mr. S. P. Weller, assistant master mechanic at Sedalia, Mo., has been moved to De Soto.

Mr. James Lonergan, who has been for many years master mechanic of the Elmira division of the Delaware, Lackawanna and Western Railroad, has been retired on a pension. Mr. Lonergan was born in Ireland seventy years ago, and has spent the whole of his working life on the Delaware, Lackawanna and Western, except a few months when he went railroading in South America.

Mr. M. J. Drury has been appointed master mechanic of the second and third districts of the Santa Fe Pacific Company with headquarters at Winslow, Ariz. Mr. Drury began work for the Atchison, Topeka and Santa Fe at Topeka as a machinist in 1889, and rose through the positions of gang foreman and general foreman to that of master mechanic. Mr. Drury is considered a remarkably able shop man in which capacity he made his mark at La Junta and Arkansas City.

Mr. Walter L. Gilmore has been appointed superintendent of motive power of the New York, Chicago & St. Louis Railway, succeeding Mr. John Mackenzie, resigned. Mr. Gilmore was for many years on the Lake Shore Railroad, having gone there from Concord, N. H., where he learned the machinists' trade. He rose successively from machinist to foreman to be master mechanic. He was for three years division master mechanic of the Cleveland, Columbus and Cincinnati at Cleveland.

Mr. George W. Wilden, mechanical engineer of the Central Railroad of New Jersey, has been one of our most regular callers. His visits stopped suddenly a few weeks ago and we were thinking of sending out an alarm notice when we received the notice: Mr. George Washington Wilden, Miss Josephine Fish, married September 15. Our assistant says he had suspicions something was coming to Mr. Wilden, and tried the pump, which was answered by a stare. George Washington could not tell a lie.

The following changes have been made in the mechanical department of the Burlington and Missouri River Railroad in Nebraska: Mr. F. J. Kraemer has been appointed master mechanic of the Wyoming division, Newcastle East, with headquarters at Alliance, Neb., vice Mr. J. P. Reardon, assigned to other duties. Mr. A. B. Pirie has been appointed master mechanic of the southern division, with headquarters at Wymore, Neb., vice Mr. F. J. Kraemer, transferred. Mr. W. F. Ackerman has been appointed master mechanic in charge of the Havelock shops, vice Mr. A. B. Pirie, transferred.

Mr. Joseph Adna Baker, a well-known railway man, joins the editorial staff of Railway and Locomotive Engineering. Mr. Baker on graduating from an engineering school entered railway service as a fireman and rose to be traveling engineer. He is an earnest believer in labor organizations and is a member of the firemen and the engineers' brotherhoods and of the Air Brake Men's and the Traveling Engineers' Associations. He has lately been employed as inspector with the Georgia Car Company. Mr. Baker will have charge of the subscription department with headquarters in Chicago. We commend him to the good will of our numerous friends.

The following changes have been made on the Chicago and Northwestern Rail-

way: Mr. H. T. Bentley has been appointed assistant superintendent of motive power at Chicago, Ill. Mr. Bentley was formerly master mechanic of the Iowa division at Clinton, Iowa, which position will now be filled by Mr. Frank G. Benjamin, transferred from the Madison division. Mr. W. H. Hufman has been promoted from the position of division foreman of the Iowa division at Boone, Iowa, to succeed Mr. Benjamin as master mechanic of the Madison division at Baraboo, Wis. Mr. Hufman will be succeeded at Boone by Mr. John P. Neff, who has been transferred from the west sub-division of Minnesota and Dakota division.

RAILWAY AND LOCOMOTIVE ENGINEERING has recently lost a very warm friend in the death of Mr. Ira F. Wallace, who was killed on August 31. Mr. Wallace was pulling the fast mail on the Chicago, St. Paul, Minneapolis and Omaha when he ran into a washout with the result that it ended the career of a very bright and useful man. He was for years a correspondent of RAILWAY AND LOCOMOTIVE ENGINEERING, and his letters were always thoroughly practical and readable. He was one of the patentees of the Wallace and Kellogg Variable Exhaust Nozzle and of several other railway appliances. He obtained two appointments as road foreman of engines, but each time preferred to return to his familiar work of running a locomotive.

We do not recall the name of any man who has dropped out of railway service of late years, who left such an aching void as that which stands open through Mr. John Mackenzie having resigned the position of Superintendent of Motive Power of the Nickel Plate line which he has held for about twenty years. Mr. Mackenzie has been a particularly active worker in the Master Car Builders' and Master Mechanics' Associations and it will be hard to fill his place, for he was particularly punctual in attending the meetings and his practical insight often helped to settle difficult questions in interchange of cars. He was for two years president of the Railway Master Mechanics' Association and his energetic proselytising brought many new members into the Association at a time when they were sorely needed.

President Ingalls' Long Service.

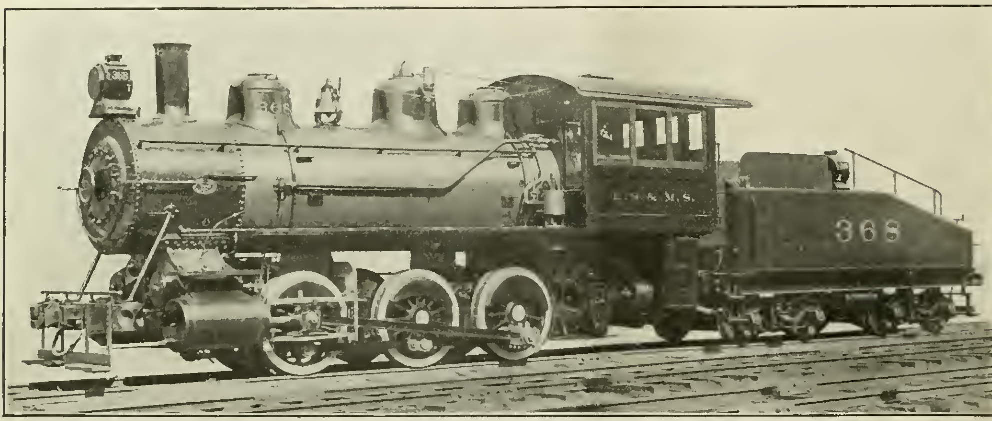
President Melville E. Ingalls, of the Cleveland, Cincinnati, Chicago and St. Louis Railroad, celebrated his sixtieth birthday recently. On November 1, of this year, he will have completed thirty-two years' service as president, receiver, and then president of the Big Four lines. Mr. Ingalls is one of the most popular railroad officials in the country, and is regarded by every person under his charge as a friend who loves justice and fair dealing. There are never to be heard rumors of storm and strife on the Big Four System, because the president has a heavy hand for the petty tyrants whose actions kill *esprit de corps.*

The value of the locomotives made by the twenty-eight engine works in this country in 1900 was $35,209,048; and the amount of money invested in these works was $40,813,793.

A conductor on the Canadian Pacific Railway, at Winnipeg, has invented a device which is intended to do away with torpedoes, used for stopping trains. It consists of a gong and hammer which can be attached to the rail in such a way that the passage of every wheel throughout the length of the train registers a stroke on the gong. The device is patented.

Six-Wheel Switch Engine for the Lake Shore.

This latest Lake Shore & Michigan Southern Railway switch engine has been turned out of the Pittsburgh works of the American Locomotive Company. The engine stands on six coupled wheels and has 19x26-in. cylinders, 52-in. drivers, and a total weight of 130,700 pounds. These engines were designed for heavy yard service and are strongly built with a view of easily meeting the exacting requirements of this kind of work, and of remaining out of the shop the full limit of time. The maximum effort of which these engines are capable, viz., 26,000 pounds, shows them to be well to the front in the matter of power, and the weight, which gives a ratio to traction of 5, indicates that the machines may be depended upon to exert the full energy developed, under any conditions of rail.



SIX-WHEEL SWITCHING ENGINE—LAKE SHORE AND MICHIGAN SOUTHERN RAILWAY.

The driving springs are behind and between the wheels, with the exception of the forward spring, which is placed over the axle box, but on a very high spring-saddle. The connecting rod drives the rear wheel and this arrangement provides a long connecting rod, with corresponding advantages. The valve gear is, however, driven from eccentrics placed on the center axle and the connection is direct, by reason of the fact that any movement of the reverse lever lifts or lowers the link block, which is attached to a valve-rod extension bar which passes up over the front axle at a considerable angle. Though the practice of driving on the rear wheel and actuating the valve motion from the axle in front, is not a new feature, it has seldom been employed in engines as heavy as the one we are considering. The taking down of the side-rods for any cause between main driver and middle wheels, effectually puts the engine "out of business." The Forney engines used on the

Manhattan elevated road in New York have valve gear so operated, and these latter are regular road engines, worked where traffic is dense, and where the value of an unobstructed main line is incomparably greater than in a terminal yard. The main valves are of the piston type, and pressure carried, 170 pounds. The smoke stack, which is of cast iron, is flared out at the bottom, and is bolted directly to the smoke box without the intervention of a cast saddle or other connecting piece, thus giving a very clean appearance to the front end. One air reservoir is hung under the cab on the left side. There is also another main reservoir placed between frames, back of the cylinder saddle. These provide ample air capacity. The air-pump is sunk below the running board to the level of the top of the air cylinder. The slope-back tank is mounted on a structural steel underframe, and has a water capacity of 3,500 gallons and fuel space capable of holding 7¼ tons of coal.

Commonwealth Steel Company's Plant.

It has been but a few years since cast steel was first introduced, in a small way, into the construction of rolling stock, and it has proven of such advantage in the reduction of the number of parts and weight and the increase of strength that it is now recognized as a permanent factor in car and locomotive design.

The demand for it in this field has encouraged the erection of modern plants for the exclusive production of railroad specialties of low carbon steel by the open hearth process.

The latest one of this nature is that of the Commonwealth Steel Co., which began operating the first week of the present month, and is a splendid example of the most advanced ideas of modern foundry design. The plant is located at Granite City, Ill., upon an 18-acre, triangular plot of ground, bounded upon two sides by three trunk lines and the Terminal Railroad, thus affording ideal traffic facilities.

The buildings are entirely of steel and brick, of light and strong design, and every foot of floor space is traversed by electric cranes. The arrangement of the buildings is such that the different raw materials come into the works by independent routes, all converge at the casting floor and the products go out by other routes, thus avoiding all confliction of raw and finished material.

The melting house is equipped with five furnaces, four of them are 20-ton basic and one is 25-ton acid, all of special stationary type for burning either gas or oil, and three are now in operation. They are charged by an electric machine of unusually heavy pattern, built especially for this plant. The furnace doors and tapping spout are operated by compressed air cylinders of cast iron, metallic packed.

The main foundry building is equipped with two 35-ton traveling cranes, either one capable of handling the largest heats poured and they operate in independent territory, never interfering with each other.

The specialties are moulded by machine in two buildings immediately adjoining the main building, and, as all the castings are all made in green sand, the moulds are carried direct into the main building by the moulding travelers and "poured" without being further transported.

The castings are shaken out by the large cranes and placed upon an inclined transfer table, which conveys them to the transfer building, where they are subjected to the first stage of finishing by being sand blasted and inspected. The product is here assorted. the scrap being loaded on cars and sent back to the charging machine, while the castings are passed through continuous annealing furnaces to the finishing department, where they are completed for shipment, tested, inspected and loaded on cars.

The laboratory is complete in all details for the rapid and accurate determination of all the chemical and physical properties of the raw and finished products.

The power plant is compact and all boilers, engines and power generators are in duplicate, one complete set of machines being held in reserve to provide for emergencies and assure continuity of operation. The electric generators are direct connected to heavy duty, double eccentric Corliss engines, and the air compressors have duplex steam and compound air cylinders with separate intercoolers. All machines are regulated automatically and are being equipped with an automatic lubricating system.

The capacity of the plant, operating three furnaces, is 150 tons of finished castings in 24 hours, and it is now being run day and night.

When the present difficulties of obtaining building material and machinery are taken into consideration the management deserve great credit for their aggressive energy in completing the plant in five months from the time ground was broken for the foundations.

The main offices of the company are in St. Louis, Mo. Mr. James Hopkins, vice-president of the Diamond Match Company, is president; Messrs. William F. Niedringhause and J. S. Andrews, vice-presidents; Mr. L. J. Hayward, treasurer; Mr. O. S. Pulliam, secretary and general manager, and Mr. C. T. Westlake, works manager. The last two being practical steel men of long ex-

perience in this line, and Mr. Andrews having been in the railway supply business for several years, they are receiving immediate recognition by the railroads in the shape of substantial orders.

Traveling Engineers' Convention.

The Tenth Annual Convention of the Traveling Engineers was held in Chicago, beginning Tuesday, the 9th ins., and continuing for four days.

The Convention opened up promptly at nine o'clock with President W. G. Wallace in the chair. The Convention was opened by prayer. Then followed the address of welcome by City Attorney Taylor, representing the Mayor, who was too busy to leave his duties to respond to the invitation to open the Convention.

The address of Mr. Robert Quayle, Superintendent of Motive Power of the Chicago and Northwestern Railroad, next followed. This address was unusually good, teeming with important suggestions and practical advice. The address will appear at length in our next issue.

President Wallace then delivered his address to the Convention body. The address was terse, concise and reviewed the Association's work of the past year.

Secretary W. O. Thompson next submitted his report. It showed the growth and progress of the Traveling Engineers' Association for the past year, and also reviewed the important features of the Association since its conception. Among other things Secretary Thompson said: "Too much credit cannot be given to Sinclair and Hill, the owners and proprietors of LOCOMOTIVE ENGINEERING for their excellent support of and interest in the Traveling Engineers' Association, the Association having been organized in the offices of LOCOMOTIVE ENGINEERING eleven years ago." Mr. Thompson also gave Hill and Sinclair further credit for having encouraged and carried the Association over rough places in the early years of its organization. The report showed that 55 new members joined the Association during the past year, bringing the total membership up to 430. The assets of the Association were shown to be $704.25.

The treasurer's report was given in detail and showed a balance of $300 in the treasury after all bills had been paid. Altogether the reports of the secretary and treasurer showed the Association to be in a very healthy and prosperous condition.

After transacting some routine business, the Convention took up the discussion of the several papers. These papers were well selected and prepared, and the discussion which followed was very interesting and instructive, coming as it did from men in daily contact with railroading. The subjects discussed were: What is the best method for draughting locomotives for all kinds of fuel, stack included? What qualifications should a man possess to fill the position of engine inspector? What is the best method of securing complete and intelligible reports of work needed on an engine to fit her for the next trip? Proper air-brake instruction to all concerned to prevent the ruination of wheels by skidding and handling of air-brakes on freight trains.

These reports were discussed at length and the discussions will prove a valuable addition to railroad literature and will be published in the Proceedings of the Convention which will doubtless be issued in a month or two.

The election of officers resulted as follows:

President, D. Meadows, St. Thomas, Ontario.

Vice-President, R. D. Davis, Chicago, Ill.

Second Vice-President, G. W. Wildin, Jersey City, N. J.

Third Vice-President, J. D. Benjamin, Milwaukee, Wis.

Secretary, W. O. Thompson, Albany, N. Y.

Treasurer, James McDonough, Temple, Tex.

Executive Committee, J. R. Belton, Covington, Ky.; C. B. Conger, Chicago, Ill.; J. S. Seeley, Franklin, Pa.

Chicago was selected as the place for the next meeting.

Entertainment Features of the Traveling Engineers' Convention.

The Tenth Annual Convention of the Traveling Engineers' Association, which was held in the Stratford Hotel, Chicago, September 9, 10, 11 and 12, was not devoid of entertainment features. The Committee on Arrangements had formulated an exceptionally good program of entertainment for the members and their ladies, which was as follows:

On Tuesday, the opening day, carriages were supplied, for the hours of 2 to 5 P. M. In the evening, members and their ladies were guests of Mr. W. N. Mitchell, General Manager of the Railroad Department of the International Correspondence Schools. The entertainment began with a reception, passed to a vaudeville performance, and then to a banquet and ball, the entertainment ending about 1.30 A. M. The committee had then scheduled "Eight Hours Rest."

On Wednesday morning the ladies were supplied with theater tickets for the evening performance of the "Sleeping Beauty and the Beast" at the Illinois Theater. The morning's entertainment consisted of visiting the big stores and shopping district and the Art Institute. After luncheon a tally-ho ride to Washington and Jackson Park was arranged to leave at 2.30 P. M. In the evening

the ladies attended the theater party. The men were busily engaged in lobby discussions and the ladies were requested to excuse them for the evening. At 11.45 the committee had scheduled "Take Siding Until Daylight."

On Thursday carriages and automobiles were supplied for the ladies for the hours of 9.30 to 12 o'clock noon. After luncheon the steamboat Easton was placed at the disposal of the members and their ladies from the hours of 2 to 5 P. M. for a trip on Lake Michigan. In the evening members and their ladies were escorted to the Studebaker Theater, where at 8.15 began the performance of "King Dodo." "There is no such a king as Dodo."

The entertainment was brought to a close because of the early departure of members for distant places. The entertainment features of this Convention were decidedly successful, surpassing all past attempts.

Exhibits at the Traveling Engineers' Chicago Convention.

The Railroad Supply Company exhibited the E. R. Cook acetylene gas locomotive headlight generator, pressure regulator and headlight burners. Also the Fahrig aluminum bearing metal.

Sellers & Co. exhibited their 1887 improved injector.

The Michigan Lubricator Company exhibited their No. 3 improved lubricator, their automatic driver brake retainer for locomotive brakes, a sight feed lubricator for air cylinders of the air pump, and their automatic steam chest plug.

The Crane Co. had their usual exhibit of safety valves, mufflers, globe and gate valve.

The Illinois Malleable Iron Co. exhibited the Westmark flue rattler, and the Bruyn automatic swinging smoke jack.

The Federal Supply Company exhibited their Toltz automatic ash pan, the Rogers car axle box receptacle, the Rogers improved journal packing, and the Robertson ash and cinder conveyor.

The Safety Train Order Signal Company exhibited their apparatus, their model being connected up with air pressure.

The Lunkenheimer Company's Catalogue.

The catalogue just issued by the Lunkenheimer Co., of Cincinnati, O., is a revised edition of that issued several years ago. New tools and appliances for doing work have been added to the company's shops, and methods have improved, so that prices quoted in former catalogues have changed. The book, of 208 pages contains cuts, descriptions, dimensions and prices of valves of all kinds, checks, pipe fittings, pop safety valves, low water alarms for steam boilers, indicator cocks, whistles, locomotive cylinder cocks, three-way steam cocks, water gauges, steam gauges, gauge cocks, injectors, lubricators, oil cups, graphite lubricators, grease cups, oil gauges, and the many products of this well known concern. In fact the catalogue seems to say, "If you don't see what you want, ask for it." The New York branch office is at 26 Cortlandt street. A copy of the catalogue will be sent to those interested, on application.

A Railroad Recruiting Office.

The Chicago & Alton Railway has made what may be called a "new departure" in the matter of picking up men for the service. The company has established an employment bureau, the purpose of which is to recruit employees from among the people living along the line of the Alton road. In a certain sense the bureau is like an army recruiting station, only there are no showy uniforms wherewith to catch "recruits." The officer of the road in charge of this department meets citizens living in the towns upon and adjacent to the railway for the purpose of getting in touch with young men of good habits and high character who wish to become and who would make desirable employees. Students in telegraph offices, clerks in various departments, operators, brakemen, firemen, etc., are recruited from persons whose record is kept by the Alton's Employment Bureau, the selections being made from those who are best suited and qualified after having passed mental and physical examinations which have been made a part of the requirements for employment. The Chicago & Alton is thus able to secure "good quality" among those who take up the responsibilities of railroad work.

The "Large Car" in Great Britain.

The success is now assured of the large 40-ton railway cars on the Caledonian Railway. The Midland Railway Company have now ordered 30, 30-ton cars with pressed steel under frames, the total weight when empty being 10¼ tons, and therefore 40 tons loaded. Three pairs of doors are fitted on the sides to facilitate unloading. It follows that these cars require heavier locomotives to obtain the highest tractive economy.

Erie's New Cab Service.

The Erie Railroad management has established a new cab service whereby passengers are transferred direct from the station in Jersey City to any part of New York at a very moderate rate. The service has become so popular that the company has supplemented it by the addition of a number of hansoms.

The Association of Railway Superintendents of Bridges and Buildings will meet in annual convention on October 21 at the West Hotel, Minneapolis.

Chicago Pnuematic Tool Co.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, has just returned from a five weeks' trip to Europe and talks entertainingly of the business situation there.

His company now own the New Taite Howard Pneumatic Tool Co. and the International Pneumatic Tool Co., of England, having recently taken over the latter company, and having reorganized these companies under the name of the Consolidated Pneumatic Tool Company.

The Chicago Pneumatic Tool Company expect to arrange to duplicate their Detroit plant in Scotland for the production of tools required in the shipbuilding work in that country. The exhibition before the Shipbuilders' Federation in Glasgow, which has recently been concluded, was highly successful, and the pneumatic tools have practically been adopted for all the shipbuilding work in the Scotland yards. The American workmen making the exhibit of pneumatic tools on shipbuilding are now in Germany, and from there will go to France for the purpose of making other exhibits.

While in France Mr. Duntley took an order for 130 pneumatic riveters for one of the largest French ship yards.

Jenkins Brothers' catalogue of valves has been received. It contains information concerning "all and sundry" valves, parts, keys, handles, etc. They make brass angle valves, iron globe valves, checks, "Y" or blow-off valves, safety valves, whistle valves, and numerous other kinds. They offer to supply a perfectly tight valve for the worst place which can be found, or refund purchaser's money. A copy of the pamphlet will be forwarded to any one desiring it, who will apply to them at 71 John street, New York, or 31 North Canal street, Chicago.

The F. P. Sargent Glove, so called out of compliment to the popular retiring grand master of the Brotherhood of Locomotive Firemen, was represented by Mr. A. Leo Kent and Mr. Horace G. Lobenstine at the Firemen's convention at Chattanooga, Tenn. The company manufacturing this glove is the Detroit Leather Specialty Company, of Detroit, Mich. On the palm of glove is a clear reproduction of Mr. Sargent's portrait and a fac simile of his signature. The glove is strong and well made, and, in fact, if an engine is at all inclined to lie down on the road, a first-class fireman has only to "put on the gloves" with Mr. Sargent's name on each, and the outcome of the contest will not long remain in doubt. The fireman may have to do some fine "side stepping" on the foot plate, it is true, but these gloves have full non-commissioned rank and are generally winners. A neat little pocket note book and a fireman's neckerchief were distributed as souvenirs and were very popular.

Mr. H. S. Peters, "the Brotherhood Overall man," of Dover, N. J., was present at the convention of the Brotherhood of Locomotive Firemen held in Chattanooga, Tenn. He did a good business among the firemen and had a little souvenir to give away, which was exceedingly popular among the ladies. It was a miniature suit of overalls with ribbon for braces. We have, however, not yet heard if Mr. Peters booked an order for overalls for the new fireman who lives in the Executive Mansion, Washington, D. C. No doubt he secured it.

Mr. J. G. Clark, vice-president of the Oshkosh Clothing Manufacturing Company, of Oshkosh, Wis., was at Chattanooga, Tenn., during the Brotherhood of Locomotive Firemen's convention. This company makes the "J. & C." suits. The material used is striped cloth, which is manufactured expressly for the Oshkosh company. Mr. Clark's portrait, as it appears on his business card, shows a fine looking gentleman who supplies firemen with union-made suits.

A practical example of "how you look" in one of the Sanders "Broad Gauge" suits of overalls was given to the delegates and visitors at the Firemen's convention at Chattanooga, Tenn., by Mr. Ed. G. Sanders, who dressed up as a fireman in one of his smart-looking suits. These garments are made from soft weave Massachusetts denims, and are said to be unshrinkable. The Sanders Manufacturing Company, of Tullahoma, Tenn., make bold to say of their goods, "The union label cannot be legitimately used on trash."

Among the recent contracts awarded to the Buffalo Forge Company, of Buffalo, N. Y., is one of particular interest. The Continental Coal Co., of Gloucester, O., have ordered three fans installed in their mines for the purpose of ventilating and exhausting fumes, smoke and all dangerous gases constantly met with in coal mining. The fans are 250 in., housing of the 3/4 type and of the special width of 72 in. The blast wheels of these fans are of the usual centrifugal type. The radial blades or vanes with backwardly curved tips are supported by two spiders of wrought iron tees springing from cast iron hubs. The fan shaft is supported, independent of the housing, by two standard Buffalo self-aligning, chain oiling outboard bearings, mounted on masonry pedestals.

The Economy Car Heating Company's Catalogue.

The Economy Car Heating Company's catalogue issued from 281 St. John street, Portland, Me., has for its opening sentence the apparently paradoxical statement that "Waste Steam Saves Fuel." The paradox disappears when the reader understands the way in which this company intend that "waste steam" shall be used. It is briefly that the heating of passenger trains shall be accomplished by the exhaust steam from the air pump instead of by live steam from the boiler. In case the exhaust from the pump should not be sufficient as might be expected with long through trains in cold weather, the deficiency is automatically made up by live steam drawn direct from the locomotive. Live steam in any case only supplements the air pump exhaust and so reduces the amount of live steam used. The draft on the fire usually made by the air pump exhaust disappears, and the panting noise in the stack, heard when the pump is working, of course, is absent. The catalogue will be sent free to those interested on application.

The Fayette Manufacturing Co. will use electrical power transmission for driving their new plant for the manufacture of refractory brick at Chester, Pa. The entire power for mixing and grinding the ingredients and for conveying them to and from the various machines, and finally pressing them into shape, will be furnished by induction motors. The Fayette Company has recently purchased from Westinghouse Electric & Mfg. Co. a 3-phase equipment, including an engine type alternator, exciter, switchboard and alternating current motors aggregating 290 horse power.

The Hayden & Derby Manufacturing Company, 85 Liberty street, New York, have issued a catalogue devoted to the consideration of metropolitan injectors, and it opens with a table of contents which is a very useful thing. There are paragraphs on a number of topics connected with injectors, among which may be mentioned, "Suggestions as to the proper type of injector to select," "The proper size to get," "Steam range of the metropolitan injector," "Reasons why injectors do not work," etc. Half tones, sections and line drawings illustrate the various sizes made. Tables of dimensions and full information are given. The metropolitan automatic injector, the "1898" model, double-tube metropolitan injectors, H-D ejectors, H-D noiseless water heaters, strainers and funnels, Hancock "swing" check valves, Hancock globe and angle valves are included in this catalogue, which closes with "A word to the buyer."

The Union Switch & Signal Company's Catalogue.

This very neatly printed catalogue is section 5 and deals with station signals used as train order or telegraph block signals. So many types of these signals and operating devices are in use throughout the country that they cannot all be included in catalogue form, so that section 5 is occupied only with the latest and best known types. Prices are given and each style of signal is illustrated with a very clear line engraving. with description sufficient for ordering, placed upon the opposite page. The Union Switch and Signal Company, of Swissvale, Pa., state that, although they intend to issue one section each month, until the entire nineteen sections are out, yet they do not intend to issue them in numerical order. Catalogue sections will be supplied on application.

The Industrial Works, of Bay City, Mich., one of the largest manufacturers of railroad wrecking cranes in the world, will shortly install a large amount of additional electrical apparatus for the operation of its shops. A recent purchase from the Westinghouse Electric & Mfg. Co. includes a 150-k.w. direct-current generator, which will be used to furnish current to eighteen or twenty direct-current motors already in use in the plant, a 200-k.w., two-phase alternator, and a number of induction motors. The alternating current apparatus will be used entirely for power distribution. In addition to wrecking cranes the Industrial Works also manufacture smaller cranes and transfer tables.

The plans for the new plant of the Cleveland Pneumatic Tool Company are about completed. The company has just opened up an office at No. 411 Park Bldg., Pittsburg, Pa., represented by Chas. L. Nelson, and at No. 34 Lemoine St., Montreal, Canada, represented by N. J. Holden & Company.

The contracts for the new plant have been awarded to Messrs. J. A. Reaugh & Son, of Cleveland, Ohio. It is expected that all will be completed within ninety days and be ready for operation. The plant will be equipped with the most modern machinery and appliances.

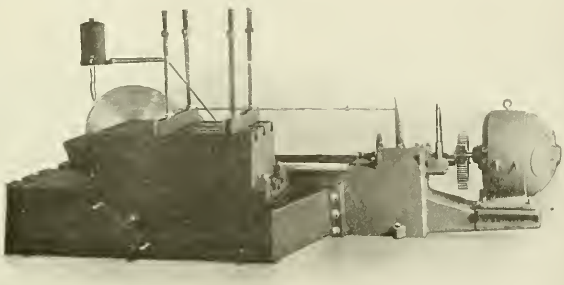
The *Iron Age* is authority for the statement that the Pennsylvania Railroad have changed their plan for building their own locomotives next year. The Baldwin Locomotive Works has received what is probably the largest order for engines ever given to a single concern by a railroad company. The order is for 250 high-class freight locomotives, the total cost of which will be about $3,250,000. All these engines are to be delivered within the first six months of 1903.

Q. & C. Metal Saw.

The accompanying illustration shows one of the latest type of metal sawing machines manufactured by the Q. & C. Co. These machines are part of the new line of saws that have recently been brought out by this concern. Machines of the type shown here have recently been installed in the new shops of the Lake Shore and Michigan Southern Railroad, and by the Chicago City Railway Co., Chicago, to be used principally for frog and switch work, but also when required they are suitable for a wide range of work on structural shapes, plates, bars, etc. The machine consists of a heavy bed saw-carriage, feeding and driving mechanism and two work tables which are fitted to the bed. The work is bolted to either of these tables and is cut off by the motion of the saw, the carriage being fed to it. The saw blade is 27 in. in dia., fine tooth, of the arbor-driven type. It has a longitudinal travel of 30 in., giving it a capacity for cutting I-beams up to 15 in. high, or 8-in. round material. The arbor is of extra large diameter, made of crucible steel, and the pinion on the arbor is formed solid with it, thus doing away with the possibility of weakness which could arise where they were keyed together. The worm-wheel shaft, on which the driving pinion is also formed solid, is of hardened crucible steel, the worm being of hardened steel and the worm wheel of phosphor bronze.

As will be seen by the engraving, the entire machine is of exceedingly heavy construction, the section of the bed being such as to afford the greatest possible rigidity in heavy cutting. All of the gears are entirely inclosed and while exceedingly simple, the saw is provided with every possible facility for economically cutting off work. In these machines there is 8½ in. of the blade available for cutting above the upper side table and with its 30-in. travel makes it an extremely desirable machine for splitting rails or other material where it is necessary to make long cuts.

Further information and catalogue may be obtained from The Q. & C. Co., Western Union Building, Chicago, or from the office at 114 Liberty street, New York.



THE Q. & C. NEW METAL SAW.

Handling Locomotives.

One of the most valuable books for railway men ever published is "Handling Locomotives," by W. O. Thompson, secretary of the Traveling Engineers' Association. Mr. Thompson has had a great deal of experience in examining firemen for promotion, and this book is the result of his experience. Every line of it contains plain facts that every intelligent engineman ought to know. The keynote of the book is: "A fair examination is the competent engineer's protection." We are not acquainted with any book which contains so much useful information in such small space. It is sold by Railway and Locomotive Engineering. Price, 50 cents, cloth; 75 cents, leather.

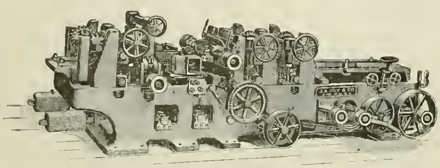
The Illinois Glass Company have recently purchased an extensive electrical equipment from the Westinghouse Electric & Mfg. Co. This apparatus will be used in the machine, blacksmith and molding shops and for blowers, etc. The equipment includes a 250-k.w., two-phase, 440-volt, 60-cycle belted generator, twenty "Type C" induction motors, thirty-eight "Type O.D." transformers and arc and incandescent lamps.

The Pittsburg Valve & Fittings Company is building new works at Barberton, O., and has placed a contract with the Westinghouse Electric & Mfg. Co. for the electrical equipment, which includes generators, motors and switchboards.

The Falls Hollow Staybolt Company announce that Mr. T. F. De Garmo, 3116 Clifford street, Philadelphia, Pa., has been appointed their eastern agent. Mr. De Garmo has had many years' experience in the railway supply business, principally in the mechanical line, and has a host of friends in the railway field.

Double-Cylinder "Lightning" Floorer.

We are pleased to show our readers an improved flooring machine, which the makers claim has embodied in its construction the necessary qualities to insure successful work. It was patented March 20, 1900, and is designed for those who make flooring, ceiling, siding, casing, etc., in large quantities. Special attention is invited to some of its principal features. It planes four sides, 9 and 14 in. wide and 6 in. thick, and by the use of the belt-tightening apparatus. 1 1-2-in. stock can be matched to advantage, this last device being an improved feature. The frame is massive, preventing vibration, and resists all strain, and the machine can be run at a very high speed if desired, being always under control of operator. The feed is six large powerfully-driven rolls, having expansion gearing, and can be easily raised and lowered, and the feeding-out one is provided with scrapers. Rate of feed can be furnished as desired. The matching works are very heavy, the cylinders four-sided and slotted, and furnished with chip-breaking lips to work cross-grained or knotty lumber, and the shaving hoods swing outward to give access to knives. The pressure bars have easy and quick adjustments, and possess many new improvements for facilitating their work. Altogether, this machine will be found to have incorporated in it many points for giving satisfactory work, inasmuch as this class of machinery has been one of the most successful specialties of its makers. J. A. Fay & Eagan Co., of No. 445 West Front street, Cincinnati, O., the makers of this tool, will willingly furnish any further details, cuts and prices, together with their new and complete catalogue, free to those interested who will write mentioning RAILWAY AND LOCOMOTIVE ENGINEERING.



NO. 15 LIGHTNING FLOORER.

The Pratt & Whitney Company, of Hartford, Conn., have issued a neat little catalogue, showing a one-spindle and a two-spindle profiling machines of entirely new design. They are specially adapted for finishing parts of guns, sewing machines or other accurate and interchangeable work. The two-spindle machine has the advantage of being able to take a roughing and finishing milling for one setting of the work. The machines are strong and compact, and very sensitive, and occupy a minimum amount of floor space. The Pratt & Whitney company will be happy to mail a copy of this 16-page pamphlet to any one interested enough to apply for it.

If there is anything that intelligent engineers pride themselves in understanding better than any other part of an engine, it is the valve motion. A man cannot make much progress in the study of valve motion by looking at the eccentrics, straps, rods and links, which are the only parts of the motion exposed to view. To understand the whole mechanism, drawings and description are necessary. These can be found in fine shape in Halsey's "Link Motion." It is the simplest treatise ever written on the subject, and costs only one dollar in this office.

Boston Mechanics' Fair.

The Boston Mechanics' Fair was opened September 22, and will continue until November 1.

The fair this year is the first that has been held in four years, and will undoubtedly be the finest exhibition ever given by this well-known association.

Mechanics' Building is already being crowded with enormous crates containing the most modern and delicate machinery of every description. This is fast being put in place, and by the 22d of this month visitors will have the pleasure of witnessing not only the manufacture of some of the most interesting products of New England and other States, but also have the chance of viewing all kinds of rare productions that are the result of man's handiwork.

Hopes for Improvement.

That our English cousins occasionally feel that they are very tightly bound by government red tape, is perhaps evidenced by a reference to the visit of a distinguished officer to the United States. Our transatlantic contemporary in the railway field, remarks: "Lieut.-Col. H. A. Yorke, R. E., the Board of Trade's chief inspecting officer of railways, has gone to America to have a look round. It is hoped that the result of this visit will be a considerable relaxation in many directions of the Board of Trade's present onerous requirements as regards the construction, equipment, and working of railways."

If Per Diem Had Come Earlier.

The Southern Railway has some interesting figures covering the cost of foreign car service and the profit which would have accrued to the company if the per diem system had been in operation on its lines last year. In 1902 this railway company paid $692,155 for mileage on foreign cars on its lines, and received $657,922 from other roads for mileage made by its cars on their lines, which left a balance against the Southern of $34,233. The average mileage of all cars on the Southern Railway line was 24.61 miles per day. Average miles per car day made by Southern Railway cars on foreign lines was 18.76. There was 57 per cent. of the total freight equipment of the company on the company's own lines and 42 per cent. was in service on foreign lines. With 42 per cent. of the company's equipment in service on foreign lines 37 per cent. of the total car mileage on the company's lines only was made by foreign cars. The report gives the following table showing the availability and cost of its own and foreign cars as follows:

Foreign freight cars on Southern Rail way lines:

Total car days	3,961,164
Total mileage	100,068,082
Average miles per car per day	25.262
Average cost to Southern per car per day (cents)	17.473
Average cost to Southern per car per mile (cents)	0.692

Southern Railway freight cars on foreign lines:

Total car days	5,174,495
Total mileage	97,142,074
Average miles per car per day	18.766
Average earn. per car per day (cents)	12.714
Average earn. per car per mile (cents)	0.677

Taking these figures as a basis and assuming the new per diem system in operation, that is, that payments for the use of cars be made on a time instead of on a mileage basis, the Southern Railway assumes that its receipts would have been as follows:

UNDER THE PER DIEM SYSTEM.

Southern cars on foreign lines:	
5,174,495 days at 20 cents per day	$1,034,899
Foreign cars on Southern railway:	
3,961,164 days at 20 cents per day	$792,233
Net bal. in favor of the company	$242,666

As the company paid out $34,233 more than it received for car service last year it will be seen that under the new system the net saving to the Southern Railroad Company for the year would have been about $276,899.

On the Santa Fe Trail.

"To California over the Santa Fe Trail," is the name of a book by C. A. Higgins, published by the passenger department of the Santa Fe. It is a most interesting book, finely illustrated, and carries the reader through much picturesque scenery, and in sight of more places surrounded with romantic association than are to be found in any other journey on the American continent. Nor is the picturesque part confined to scenery; there are a great many illustrations of the human denizens along the Santa Fe Trail who make attractive settings to their wild, weird surroundings. Every person who goes to California, or who is thinking of making that attractive journey, ought to read this interesting book, which can be obtained from the Passenger Department, Santa Fe, Chicago.

Montreal to London in Four Days.

It is planned by the Canadian Pacific Railroad to make a landing on the west shore of Ireland for its proposed line of fast steamers from the eastern terminus of its line to the British Isles.

The Galway coast landing is only 2,150 miles from Halifax, which will be the eastern terminus of the Canadian Pacific Railway. When the distance between New York and Liverpool is stated to be 3,150 miles, the advantage of the Halifax-Galway route for speed will be appreciated. The Canadians expect that a twenty-four knot steamship can make the ocean trip in three days and that London can then be reached in twelve hours from Galway. On this side, the distance from Montreal to Halifax can be covered in fifteen hours, making the whole time from Montreal to London four days, nearly.

An ingenious card device for displaying the colors of Dixon's Silica-Graphite Paint in such manner as will permit of an exact idea of each color, is being issued by the Joseph Dixon Crucible Company. The color chart carries with it suggestions as to the class of construction that can be protected with this paint, also instructions as to best methods of applying protective paint. The new color chart can be secured by request to the Joseph Dixon Crucible Company, Jersey City, N. J.

A strike is threatened at the plant of the Rome Locomotive works, a notice having been served on the company by the Machinists' Union that they would demand a day of nine hours for ten hours' pay. There are about twenty machinists who belong to the union in the plant and they also demand that only one apprentice be employed to every five journeymen, and that only union men be employed.

"Catechism of the Steam Plant," by F. F. Heminway, costs 50 cents and gives more information for the money than any book we are acquainted with. Its study is a good introduction to steam engineering.

Australian Transcontinental Line.

The commonwealth of Australia is again considering the project of building a transcontinental railway to connect the inhabited eastern part with the sparcely settled west. The first sections of the railway, which will run through South Australian territory for the whole of its length, have already been built by the South Australian Government. About 1,000 miles of line have yet to be constructed. The existing sections are built on a 3 ft. 6 in. gauge and where traversing the great stretches of level country the rails are held on the plain with very little earthworks and no engineering difficulties.

The credit of having reached the highest altitude on record is given to Dr. Bersen and Dr Suring, of Berlin. They first went up to the height of 30,000 ft., losing consciousness for brief intervals. They continued to ascend to 33,790 ft., when one of them became completely unconscious and could not be aroused. The other aeronaut, after making a great effort in opening the valve to descend, also became insensible, and neither of them recovered till the balloon dropped to 16,000 ft.

Interlocking.

Referring to the litigation between the Kettle Valley Line and the Vancouver, Victoria and Eastern Railway in connection with their respective lines between Grand Forks, B. C., and Republic, Wash., the general manager recently stated that one company had a record of 22 injunctions against its opponent, which itself was the authority for 19 counter-injunctions.

Transportation Problems.

A press dispatch from Belfast states that the engineering section of the British Association has been much interested in the model of an electric express train, maintaining full speed which paradoxically "stops at all stations." The idea is that a simple train composed of several corridor carriages as it passes each station drops off behind one carriage containing passengers who want to alight there, and picks up in front another from that station, all this being done while the train is traveling at full speed. The carriage to be attached has to start in advance and get well under way by the time the train catches it, and is coupled by a patent automatic arrangement. The scheme is only possible where each carriage has its own motors on the multiple unit system. The dropping of a coach from the rear of an express without stopping the train is nothing new in England. A vehicle so handled is called a "slip coach."

CONTENTS.

The W. C. Hunt Company, of West New Brighton, Staten Island, N. Y., have now ready for distribution catalogue No. 029, which is concerned with cable railways for handling coal and merchandise. The pamphlet is well illustrated throughout, with views taken from actual installations, and full descriptions are given. Cable railways are capable of almost any amount of power, strength and flexibility, and are well adapted for heavy grades, and are suitable where may changes of curvature in the line are necessary. Write the C. W. Hunt Co., 45 Broadway, for catalogue or further information.

People looking for books ought to look over the list of books in our advertising pages. All the engineering publications of most interest to railway men are to be found there. But our book department does not confine itself to railway books. It undertakes to supply every kind of book, magazine or other form of publication in print. It will give prompt attention to any order received.

On a recently constructed electric road the State Board of Railway Commissioners sanctioned the use of an inverted trough for the overhead construction where the electric road crossed a steam railroad. This insured the trolley against jumping from the overhead wire and stalling the car in a dangerous place. Such an excellent precautionary feature should be widely used.

We understand that the exhibition of ship riveting which the Chicago Pneumatic Tool Company are making in Glasgow is proving highly successful. The work there is in charge of Mr. E. Guennell, who was for many years superintendent of the Chicago Shipbuilding Company at South Chicago, Ill. He reports that favorable progress is being made and great interest is taken in it by shipbuilders on the Clyde. To further assist in this work, the Chicago Pneumatic Tool Company have sent two expert riveters from the Chicago shipyards to Glasgow. The company have recently sent Mr. F. D. Johnson, manager of their New York office, to push business there, and have also sent Mr. George H. Hayes to take charge of the mechanical work in their London works. Mr. W. H. Armstrong will have charge of the New York office.

The scarcity of freight transportation facilities, it is said, has caused the Pennsylvania Railroad to place orders for 1,500 freight cars, the majority of which are to be 100,000 pounds capacity and the remainder of 80,000 pounds capacity.

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

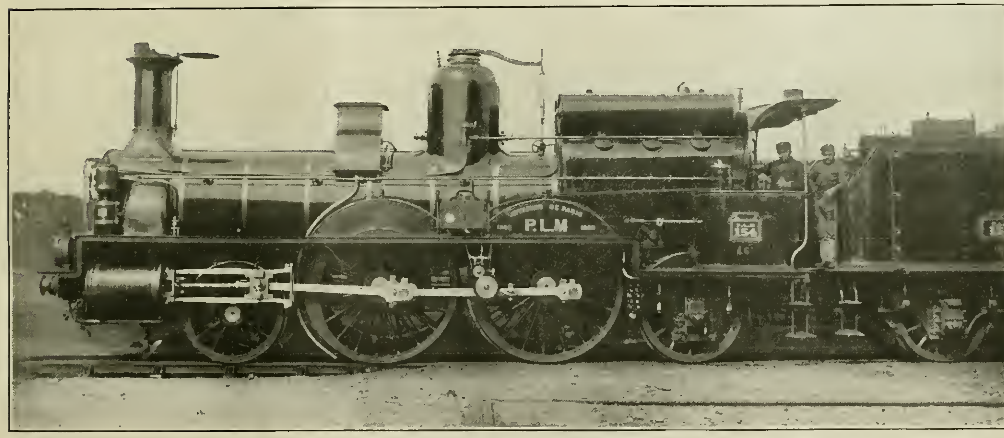
Vol. XV. 174 Broadway, New York, November, 1902 No. 11

Accurate Definition.

A green fireman of foreign extraction was recently put to fire a heavy freight train on one of our leading roads. On his run was a tunnel passing through a high hill, and there happened to be a very considerable grade up to the center of the tunnel. This fireman, however, succumbed to the accumulation of gas in the tunnel as the engine was working hard and moving slowly. When taken out he was revived by heroic means, as one might suppose. He thereafter refused to fire on the division with a "hole in a hill and a hill in the hole."

Paris, Lyons and Mediterranean Locomotive.

The man who travels much through the world has occasion to see a great many curious-looking locomotives, but for oddities French railways appear to be ahead of all others. We show a halftone herewith of what is quite a modern locomotive belonging to the Paris, Lyons & Mediterranean Railway of France. The engine was built in 1880, but the fact can be noted that it is the Atlantic type of engine, except that there is only one pair of leading wheels instead of a four-wheel truck. The gearing attached to the side rod is a speed indicator. These are not steam drums on the top of the firebox, but the main air reservoirs for the engine. We need give no further description of this odd-looking locomotive, for the picture speaks for itself. We are indebted to Mr. A. K. Bell, president of the Locomotive Magazine Company, London, for the interesting photograph from which this picture is made.



FRENCH EXPRESS ENGINE.

Cost of High Train Speed.

We are not aware of any railway engineer having devoted as much intelligent attention to finding out the cost of high train speed as Mr. F. A. Delano, general manager of the Chicago, Burlington & Quincy Railroad. Several years ago he submitted a paper on the subject to the Western Railway Club, and in 1901 he was chairman of a committee of the American Railway Master Mechanics' Association, which reported on cost of running trains at high speed. That report contained more original information on the cost of high train speed than all the other reports, papers and discussions previously given to the public. In this year's report of the American Railway Master Mechanics' Association another report from Mr. Delano is published, which reads as follows:

"My only reason for accepting the invitation of the American Railway Master Mechanics' Association to be heard again on the subject of running trains at high speed is, that there seems to be, through lack of interest, or some other cause, very little said by those who are competent to speak, and who could throw useful light on this subject. From the start, the discussion on this subject has been confused as between the question whether high speed pays, and the question of what high speed costs—obviously two very different and distinct questions.

Two prominent trunk lines between Chicago and New York have recently put on trains to make the distance in twenty hours; both of these trunk lines express their willingness to make the distance in eighteen or even sixteen hours. These trains start from Chicago equipped with powerful engines, hauling four cars, including the dining car. It is not for me to say that such trains do not pay; the question is for the officers of the companies concerned. The question which, as an engineer, I am concerned with is, what it costs to operate such trains, taking all phases of the problem into consideration.

In a sworn statement before the Senate

and House Committee on Postal Service, when urged to make an estimate or give an expression of opinion as to the cost of running trains at high speed. I stated that while I ventured only a guess, based on very insufficient data, I thought the cost of operating trains at speed increased in a greater ratio than the speed, and in a ratio amounting to perhaps 1 1-2 times the speed. The more I thought about the question and studied the evidence, the more I have come to the conclusion that this statement was no exaggeration.

I shall not attempt to rehearse at the present time the analysis of the subject which was made in my original paper to the Western Railway Club, subsequently referred to the American Railway Master Mechanics' Association for discussion, but there are some phases of the subject which a better opportunity for studying has enabled me to appreciate more fully. Many railroads have spent immense sums of money for reducing curvature, simply to make high speed possible, and in such cases high speed service should bear a very large share of the interest on this expense. I know a valley line, about 25 per cent. of which is curvature; the curves are generally from 3 to 5 degrees, and with trains running up to 35 or 40 miles per hour, were never considered objectionable. Furthermore, as the grades of the line are excellent, for freight traffic this line could not be excelled. The acceleration of some passenger trains, however, to 45 or 50 miles per hour, on this valley line at once demonstrated that the curvature must be greatly reduced, and to bring the line up to possibilities for trains scheduled at from 50 to 60 miles per hour, inclusive of stops, would necessitate an expenditure of millions of dollars.

In my original paper I dwelt at some length on the interference to freight traffic and other slow speed traffic on account of high speed trains. New light I have gotten on this subject makes me venture the following assertion based partly on estimates. Given a single track railroad of water grade:

A large volume of coarse freight traffic amounting to say 150,000 tons per track mile per month, chiefly in one direction, or of nearly double this if the traffic is evenly balanced, could be readily handled, providing there was little or no passenger traffic to interfere with it. The number of passing tracks, and the length of these passing tracks would not have to be very great, and the "factory" cost (to use the political economists' expression) of doing the work, would not exceed 15 mills per ton mile. If on this railroad, with this amount of traffic it was attempted to add one, two or more passenger trains, the effect would be immediate; first, in the detention of the freight trains, which would cause a congestion and prevent the normal movement, and we would immediately require long passing tracks so that passenger trains might meet and pass freight trains.

I venture the assertion that the capacity of the railroad would at once be diminished and the cost of doing business would at once be increased on the entire freight tonnage handled by not less than 20 or 25 per cent. If several high speed trains were run the capacity of the road would be so far curtailed that double tracking would probably be necessary for a greater part of the line.

Without further argument I submit that either my statements are very wide of the mark, in which case they should be challenged, or else that it is high time that railway managers and engineers, both mechanical and civil, should consider this subject.

The belt conveyor in handling materials represents the continuous forward movement of material, and the amount carried by any given conveyor is proportionate to the speed. The more nearly railway train service in handling tonnage over a railroad approximates the conditions of the belt conveyor in carrying material, the more economical will the work be done."

An Automatic Speed Controller.

The men running locomotives in most countries on the Continent of Europe display so little judgment about speed that nearly all the locomotives are provided with speed indicators. Some of the French lines have gone further than merely indicating the speed. They provide an apparatus which automatically applies the brakes when the speed becomes excessive. It is thus described:

One of the locomotive axles drives a small centrifugal pump sending water from the tender into a small cylinder, the piston of this cylinder being raised by the water against the compression of a spring, moving up and down, according to the speed of the pump or locomotive. A registered apparatus, tracing a speed curve, is connected with the piston, which latter —on the speed rising above the appointed limit—acts upon a device connected with the air brake pipes. A certain quantity of air is thus permitted to escape, throwing on the brakes.

Crosshead Mileage.

An Irishman crossing the Channel was observed to resolutely pace the deck of the steamer from the time she left until she arrived at the other side. He subsequently demanded the return of his passage money on the ground that he had "walked every step of the way." On much the same line of reasoning the crosshead of a locomotive might claim that it had traveled from one terminus to another with the engine, but that it had also moved up and down the guide bars all the time. It is true that the Irishman had walked continuously during the voyage, but the mileage made on his feet was considerably less than that traversed by the packet, and in the same way, a moment's calculation will show that the crosshead of a locomotive makes far less mileage than does the engine on which it works.

For example, if the stroke of an engine be 24 in., and the diameter of the driving wheels 72 in. it will turn out that the crosshead has a comparatively easy time of it as far as mileage is concerned. For every revolution of the driving wheels, the engine will move forward 18.85 ft., while the crosshead will move down the guides 2 ft. and back 2 ft., or a total of 4 ft. in all. The driving wheels will make approximately 275 revolutions in one mile, and each revolution will mean a 4-ft. excursion for the crossheads. It will travel up and down the guides about 1,100 ft., while the engine makes a mile. In 100 miles run by the engine the crosshead will have traveled just something over 20 miles, or more accurately 20.83 miles. In this particular case the crosshead makes a little over 20 per cent. of the engine mileage, though it rides, along with the bell and smokestack, the other 80 per cent. of the total distance traveled by the engine.

The First Valve Motion.

To whom who hath, much shall be given, is a saying that comes home to us frequently, as we read of credit given for inventions to people who had nothing to do with the invention. In some remarks published recently about valve motion, we read the assertion made that the valves of pioneer steam engines were turned by hand and that James Watt invented the first motion that operated the valves automatically. That was done before Watt was born. There was a boy named Humphery Potter, employed opening and closing the valves of a Newcomen engine. It was a tedious job and gave no time for play or "scoggan," as play was called in the north of England in those days. Humphery was fond of play and possessed the inventive faculty. He devised a system of strings connecting the walking beam and the valve handles, which opened and closed them automatically. It improved the operation of the engine about 25 per cent.

The Pennsylvania Railroad adopted six years ago specifications for basic open hearth steel passenger car axles as follows: Carbon, 0.35 to 0.50 per cent.; phosphorus, not over 0.07 per cent.; manganese, not over 0.60 per cent.; sulphur, 0.03 to 0.05 per cent.; silicon, not over 0.10 per cent. Only four of these axles out of 380,000 used have broken in service, says the *Iron Age*. Many railroad companies persist in using Bessemer steel for axles, and that material is infamous for the number of axles that break in service.

High Water in Chili.

One of our readers sends us the photographs from which the annexed high water views were made. Writing from Concepcion, he says: "Owing to heavy rains and floods and bridges being cut and others falling down, I have been cut off from home and headquarters for over a month. I enclose you a photo of the Rio Clara bridges on the third section of the State Railway taken from the north, and on the south side you will see half of the original bridge that fell

in September, 1899, the flood washing away about 200 yards of grading. This was built up with a temporary pile bridge made by riveting two rails together, which in turn fell in the following June, a little to the north of where the group is standing, letting a Roger ten-wheeler and four cars into the river. Rebuilt again, and fell on the 25th of June last while a passenger train was crossing it, with 80-ton Dubbs, 18 x 24-in. cylinder coupled 6-ft. 6-in. drivers. The locomotive is entirely out of sight, buried in the sand. Coupled to engine are horse and baggage cars, which you see in the water. Section engineer and bridge carpenter were drowned in this accident, all the others being saved.

"I naturally suppose you are interested in the railway world's doings. Things have taken a turn for the better of late, owing to the Chili and Argentine Governments coming to friendly terms over their long disputed controversies, which have caused exchange here to jump up from 13 to 15⅝ pence per Chilian dollar, a big item for us, viz. a raise of 30 cents per day. Passenger men get $5.80 and old freight hands $5.55, Chilian currency."

HIGH WATER IN CHILI.

Funeral Dirge and British Manufacturers.

The losses which British manufacturers have been sustaining through American competition are slowly arousing the people to a sense of their weakness in competition with the young giant. Even the slow thinking *Times*, of London, is realizing the danger and thus warns its countrymen in the form of a ponderous epitaph:

Here lies a people whose rare gifts of energy, good sense and integrity raised them above all other peoples when those qualities were all in all. But they lacked intelligence and despised it; and, lacking intelligence, they fell from their high estate as soon as the world's prizes began to be awarded only to those who brought a trained and disciplined intelligence to the understanding of its laws—moral, economical and physical.

A Pair of Friends and Consequential Damage.

Brown and Jones are both railroad men, and great friends. Brown has a comfortable room at his boarding house, furnished by himself. Jones called the other day when Brown was out and the landlady, knowing both men to be friends, let Jones go up to Brown's room to wait. Jones sat down in Brown's easy chair, and seeing a box of cigars on the table, helped himself to one and smoked it in ease and comfort. When Jones had finished the cigar he rose to go, as Brown had not returned. He threw the butt end of the still lighted cigar into the waste paper basket and went out; the cigar did not; it smouldered for a little while and then set fire to the papers and other débris in the basket. Flames soon reached the table cloth and were leaping up preparatory to a general conflagration when the landlady rushed in, and with several pitchers of water and much outcry, put out the fire. When Brown came home he found his table cloth destroyed, the box of cigars gone up in smoke, the manuscript of his article for Railway and Locomotive Engineering burned to a crisp, the arm of his easy chair scorched, and the waste basket in ashes, and a hole burned in the carpet. He made out an inventory of his losses as follows: Table cloth, $2.00; box of cigars, $10.00; prospective value of manuscript, $10.00; repairs to easy chair, $1.50; waste basket, $1.50; damage to carpet, estimated, $5.00. Total, $30.00. Brown and Jones failed to agree (though they were perfectly friendly) on the actual amount of loss Jones' visit to Brown had caused, for which Jones was responsible. At length they determined to leave it to a committee for arbitration. The committee very carefully divided the damage into primary and consequential. They found that Jones had helped himself to one of Brown's cigars—uninvited—and had consumed it, this was the primary loss, for which Jones was fully responsible; all the rest was consequential damage. Jones paid 10 cents for the cigar, and generous fellow that he was, said nothing about his car fare when he came over on the trolley to pay it, and so the incident closed. Brown now wonders if he was not guilty of contributory negligence in having anything in his room that anybody could possibly set fire to or damage in any way.

English Engine With Cylindrical Fire-Box.

The Lancashire and Yorkshire Railway have recently designed a powerful goods locomotive of the eight-coupled type with a cylindrical fire-box. The engine has been thus equipped for experimental purposes. Boilers with cylindrical fire-boxes have been used before now on English railways, but chiefly in those engaged in switching service. The L. & Y. engine has 2,017 ft. of heating surface. This fact proves that boilers with this style of fire-box can be made with large heating surface. Commenting on this engine, *The Engineer* (London) says, "It may yet come to pass that a system which has been tried on the continent may come into use in England. The engine would run fire-box end first and a bogie would be placed partly un-

der the foot-plate, and partly under the fire-box, or Mr. Stroudley's system might be tried, the leading and driving wheels being coupled and a bogie put under the fire-box. The good points in favor of the cylindrical fire-box are so many that if the experience of the L. & Y. Railway do not falsify our anticipations, it will be worth while to sacrifice some prejudices and make a new departure in locomotive design."

Atlantic Type for the C. & O.

The American Locomotive Company, at their Schenectady shops, have recently turned out some Atlantic type engines for the Chesapeake & Ohio Railroad. The type here shown is a splendid second for the 4-6-2 machine recently made for the same road, which we illustrated in our October issue. This engine is simple, with 21x26-in. cylinders, 72-in. drivers, and weighs 173,000 lbs. There are 93,000 lbs. on the drivers under ordinary circumstances; the traction increaser, which is similar to that used on the New York Central, will put about 12,000 lbs. additional on the driving wheels. We illustrated the action of the traction increaser in our June issue. The C. & O. engine has piston valves, and the cast steel valve rod extension-bar passes up over the forward driving axle in an easy curve and terminates in a rocker, with arms hanging down, so that the engine has therefore direct connected valve motion. The crosshead is of the two guide bar type and is secured to the piston rod by a nut. The fire-box is, of course, of the wide type for bituminous coal, and the total heating surface is 3,505 sq. ft., or curiously enough, just one square foot less than the amount in the Atlantic type engines on the New York Central, an account of which we published in August, 1901.

These C. & O. engines have the running boards which pass right out to the end of the smoke box, and the "front foot plate" as such, has disappeared, the buffer beam being the only place in the front where a man can stand. The headlight is electric and is of the Pyles-National type. The cab, which is made of steel, has the familiar C. & O. ventilators in the roof. An additional air reservoir is carried on the back of the tank. The enginemen's tool boxes are permanent steel ones on each side of the tank, and the lid shuts down so as to make what looks like a very satisfactory and coal-dust-proof box.

A few of the principal dimensions are as follows:

GENERAL DIMENSIONS.

Gauge, 4 ft. 9 in. Fuel, bituminous coal.
Weight in working order, 173,000 lbs.
Weight on drivers, 93,000 lbs.
Wheel base, driving, 7 ft.
Wheel base, rigid, 16 ft. 6 in.
Wheel base, total, 27 ft. 6 in.

CYLINDERS.

Size of cylinders, 21 in. x 26 in.
Dia. of piston rod, 3½ in.

VALVES.

Greatest travel of piston valves, 6 in.
Outside lap of piston valves, 1 in.
Inside clearance, ⅛ in.
Lead of valves in full gear, line and line, $\frac{3}{32}$ in lead at 6 in. cut-off

C. & O. LATEST ATLANTIC TYPE EXPRESS ENGINE.

WHEELS, ETC.

Dia. of driving wheels outside of tire, 72 in.
Dia. and length of driving journals, 9½ in. dia. x 12 in.

BOILER.

Style straight top.
Outside dia. of first ring, ½ in.
Working pressure, 200 lbs.
Thickness of plates in barrel and outside of fire box, ½, ¾, ⅝ and 1 in.
Fire box, length, 96⅛ in. Fire box, width, 75⅜ in.
Fire box, depth, 80¼ in. F.; 69 in. B.
Fire box, plates, thickness, sides, $\frac{5}{16}$ in ; back, ⅜ in.; crown, ⅜ in.; tube sheet, ½ in.
Fire box, water space, 4 in. x 5 in. front, 3½ in. x 5½ in. sides, 3½ in. x 4½ in. back.
Fire box, crown staying, radial, 1⅛ in. dia.
Tubes, material, charcoal iron No. 12, W. G.
Tubes, number, 396. Tubes, dia., 2 in.
Tubes, length over tube sheets, 16 ft.
Fire brick, supported on water tubes.
Heating surface, tubes, 3,298.08 sq. ft.
Heating surface, water tubes, 27.09 sq. ft.
Heating surface, fire box, 180.7 sq. ft.
Heating surface, total, 3 505.87 sq ft.
Grate surface, 50.32 sq. ft.
Smoke stack, inside dia., 18 in.
Smoke stack, top above rail, 14 ft. 10 in.

TENDER.

Weight, empty, 51,800 lbs.
Tender frame, 10 in. steel channels
Tender trucks, 4 whl. center bearing with wrought iron side bars and chan. bolsters
Water capacity, 6,000 U. S. gallons.
Coal capacity, 9 tons
Total wheel base of engine and tender, 55 ft. 3⅛ in.
Westinghouse aut. air brake on all drivers and trailer and for tender and train; 9½ in. air pump. Westinghouse engineer's air signal. Westinghouse high speed attachment. Main reservoirs, capacity of, 60,000 cu. ins.

How Terry Bennett Got the Bouquet.

BY SHANDY MAGUIRE.

It was on a bleery afternoon in February several moons ago, when the wind was tossing the snow into drifts in the cuts, that Terrence Bennett, the foreman of Pendleton roundhouse, was saluted by one of his men as follows:

"Come to the 'phone, Mr. Bennett."

"Do you know what I am wanted for?"

"No, sir. Acker said you are wanted in a hurry."

Acker should be general manager, in his own estimation, and to nag Terry—as he was known familiarly—he would not give messages for him to any one else through pure, unadulterated cussedness. Terry often winced at the insignificance of some of the messages he had to leave his men to take. He was factotum general to everybody, so he went to the 'phone. In reply to his "What is wanted?" came this: "Get a pair of wheels as soon as possible and go to train 44 at Sedgwick's Crossing; a car is broken down."

"What capacity?"

"I don't know."

"Find out if it is a 50, 60 or 80 journal is required."

"The wires are busy and if I go to break in, he'll throw open his key."

"You open your key and do not let him work until he answers you. If there is anything more important on the line going on than a crippled freight train to be gotten out of the way, so as to let passenger train pass, which is due to leave here in 24 minutes more, we would like to know it."

If there be those who think that the proper thing Terry should have done was to get a pair of wheels of each capacity and go out to the trouble, as Paddy Ryan would say to his wife pay nights, when she'd be calling for a bill of items to find out how much of his pay he collared

on her: "Hould on awhile, Mary, dear, and you'll be answered." Every track was gorged with snow. There was no way of loading the wheels but by improvised skids, as no derrick car was kept, and as Terry had but four men to command, it was enough for him to play with one pair—there goes the 'phone again:

"He says now that it is a truck is wanting."

"What capacity?" said Terry.

"He'll not answer me if I ask."

With an exclamation that would not get a pious response from a band of ancient spinsters occupying the amen corner of a country church, Terry made a jump ing to this debate, doing nothing, and I going out with four men to clear a wreck."

"I'll do as Dougherty says, and to hell wid ye."

Bennett could get no information at Fraser. He took a truck from under one of the cars and pushed it ahead of his engine to the broken down car. In one hour and 45 minutes, by intelligent work, and the assistance of spectators, he repaired the car and got back to Fraser, having run 3 miles each way in the meantime. When he returned he found the passenger train there awaiting his return to go ahead, and the snow plow behind ahead of several others. He read it and whistled. It was a letter from the Div. Supt. to the Gen. Supt., then forwarded to the M. C. B., then to Terry, commenting on the time the passengers were held on Fraser siding without supper, all owing to there being no car truck at Pendleton. He replied back that he supplied a truck quicker than it could be got out of the snow. The correspondence kept coming and going between Terry, the M. C. B., the Gen. Supt., and the Div. Supt. for full two months, apparently crowding the M. C. B. Dept. into a hole. Terry was loyal to his chief, and swore a mighty oath he'd make a clean breast of the whole

THE NORTHERN PACIFIC PENINSULAR EXTENSION—LAYING TRACK IN AN UNFINISHED CUT.

out of the office, telling his brakeman to nose into a 50,000 and 60,000 pound empty car and push them to Fraser (Fraser was a station half way between the station Terry was at and the crippled train) expecting to get information there from the brakeman who brought in the news. He then went to Deegan, the section boss, for some men to help at the job. Deegan said in reply to the request for the six men:

"Dougherty tould me to keep me min shovelin' the snow."

"But there is a broken down train up at Sedgewick's Crossing, and right here is a train full of passengers, due to leave, which I have running rights over. Do you refuse me help?"

"Dougherty will discharge me if I don't do as he tells me."

"Damn you and Dougherty for a pair of D. D's. There are sixteen Dagos listen- the passenger train standing on a siding.

When Terry had reported himself in, the conductor of the passenger train was asked if he wanted the plow to run ahead of his train. He replied: "I can go through alone."

The Puddinghead stuck in the snow about 5 miles up. The plow followed him, and helped him out.

Terry chuckled to himself as he saw the way things were moving. He did an active three hours' work to clear the track and return to the starting point in that time, and he felt safe from official censure, when a review of the affair would take place. In fact, he expected a bouquet. He got it.

About two weeks after the occurrence, as he was perusing his train mail, he lit upon a letter in the handwriting of the M. C. B.'s chief clerk, and opened it affair, and sent for his confidential chum, Paddy Ryan, to talk it over before doing so.

"Say, Paddy," said he, "look at this big bundle of blatherskiting about that breakdown at Sedgwick's last February. To read it is enough to make a civil dog strike his father, or throw his old mother into the ditch. The Operating Dept. is magnificent at letter writing, but where is the blame? In the first place, the conductor of the crippled train should have clearly stated what was broken when he asked for help. Secondly, the despatcher should not let the passenger train leave till the track was reported clear. Third, its puddinghead conductor should not be asked about what he knew nothing. Fourth, Dougherty's head should have been pounded down to normal proportions in a pulp mill, to restrain him from

giving such orders as he fired at Deegan, and lastly, Deegan should be sent back to keep a lookout for fairies on the topmost crag of the Rocks of Kerry, at Dougherty's expense; all this I'm going to say in reply to this wind-bag of a letter, and put the saddle on the right horse."

"No, yer not," says Paddy.

"Why?"

"Because the General Super, the super, Dougherty, and Deegan will light on yer back like a bee on a posey the first chance they get if you do."

"Am I to be put in the hole?"

"Sure! 'Twill save trouble to go into the hole and pull it in after you."

"So there is nothing left for me to do?"

"Yes, there is."

"What it is?"

"When you're nicely slicked up in the hole, grin and bear it. 'Tisn't one cint out of your pocket how much they make jackasses of themselves, but don't you be one."

Terry took his advice.

Chattanooga Shops of the C. N. O. & T. P.

In addition to the new coal handling plant now being installed at the Chattanooga shops of the Cincinnati, New Orleans and Texas Pacific Railway, the company has put in a new air compressor with capacity of 250 ft. of free air per minute, to meet the demands made for the use of air, owing to increased yard capacity. The cars are now cleaned with air as well as having brakes tested and reservoirs charged in the yard. The compressor was made by the Laidlaw, Dunn, Borden Co., of Cincinnati.

The station, shops and yards are now being lighted by electricity, with arc and incandescent lamps, supplied from two dynamos lately installed.

The car department at this point has orders to build 30 box cars of 60,000 lbs. capacity, with wooden frames, and Buckeye trucks; also three standard 4-wheel cabooses are in hand. Fifty wooden 40,000 lbs. capacity gondolas are being converted into side dump ore cars. The increased business of the road has also compelled the company to construct a freight yard, outside the city limits, capable of holding about 600 cars, work on this is being pushed rapidly.

TRACK LAYING IN THE WOODS.

Fascinations of Machinery.

The fascination of machinery suffers no decline, as one may see from the number of citizens who stand interested before the simplest operations of drills and derricks in the rapid transit subway. The point of view, as revealed by the comments of the lookers-on, is that of Ruskin rather than that of Walt Whitman. To the first a locomotive was full of wonder because it was so nearly a human thing; to the other the cleverest mechanism was interesting because its finest ingenuities were yet, by contrast, inferior to nature—"the narrowest hinge in my hand," Whitman said, "puts to scorn all machinery." One of the judges of a court in this country finds the advertisements of engineering journals capable of yielding him a whole evening's entertainment. They are illustrated as fully as the advertisements in popular magazines. But he complains that he does not find them quite so absorbing as in the days of the contest between link-and-pin and vertical-plane car couplers. Then page after page was filled with rival exploitations. Finally, aided by the decision of the Interstate Commerce Commission, the vertical-plane coupler overcame its simple, old-fashioned, finger-jamming competitor, and the war stopped.—N. Y. *Sun.*

United States Consul B. H. Warner, of Leipsic, reports to the State Department that the directors of the Prussian State railroads have recommended to the Minister of Public Works that a bill be introduced in the Prussian Parliament providing for the construction of pressed steel coal cars of 20 tons carrying capacity. The minister, after giving the matter careful consideration, has suggested that the proposals be somewhat modified, and as soon as the bill is amended it is believed that Prussian State railroads will place pressed steel cars in commission.

The Lake Shore & Michigan Southern Shops at Collinwood, Ohio.

The expression "Up-to-date" is far too hackneyed to fairly express the general scheme to economic railroad shop construction and operation which is to be seen at the L. S. & M. S. town of Collinwood, which lies a few miles outside the city of Cleveland, O. The ground owned by the company is ample for present and future needs and the entire design of the "works," for so they may be called, is such that no shop will block the further extension of any other as occasion may require. The shops are not only what the "Lake Shore" need to-day, but are capable of being made what the larger requirements of the future may demand.

A neat little brick building close to the street contains the offices of the master mechanic, and in time, when the car department moves to Collinwood, the master car builder will have his headquarters under the same roof. At present the locomotive department only is represented principally by a building of three sections which measure in all 245 ft. front by 532 ft. long. The structure is made of brick with steel columns supporting the roofs. The lighting of the shops is excellent, both from roof and side windows.

As one enters, the boiler shop is to the extreme left and extends the full length of the structure, and is 77 ft. wide, the side wall being pierced by large high windows. The riveter tower is at the far end. A 60-ton electric crane covers the entire area of this shop and renders the transportation of material an easy matter.

Passing from the boiler shop to the right, between a row of steel pillars, but practically under the same roof, is a belt of shop floor 50 ft. wide, containing the light machine tools, the heavy tools being arranged still further to the right, this latter area being served by a 15-ton electric crane. Next comes the erecting shop, over which, with a span of 68 ft. a crane of 100 tons capacity travels, with a 25-ton crane serving the same area for individual parts, but at a lower level. The heavy machine floor is 50 ft. wide, and contains a longitudinal track about 18 ft. from the erecting shop posts. All the erecting shop pit tracks, which are at right angles to the length of the shop, are extended back so as to meet this longitudinal track in the heavy machine shop, and this 18 ft. space behind engines in the erecting shop becomes a most important area for the fitting up of heavy work, the storage of wheels and the collecting of material from engines as they are stripped.

The space behind the engines is not only devoted to assembling the various parts, but is used for fitting driving boxes on axles, and other heavy work of a similar kind. A small jib crane brought to the workmen by the overhead traveler, and placed in sockets on one of the shop posts, provides temporary facilities for handling heavy pieces.

In the area set apart for the light tools is the wash room, for the men. This sanitary department, as it may be called, contains closets, wash basins, etc., which a modern hotel of good class, might envy. Above the wash room are to be arranged lockers, so that every employee of this huge establishment will have a safe and convenient place to keep his clothes. The grouping of the tools is excellent, all are so placed that work as it enters the machine shop, be it heavy or light, will not be moved backward and forward as it goes through various stages, but will progress in orderly fashion with minimum handling and movement, toward its final position.

An engine, when booked for general repairs, arrives on the turntable outside the boiler shop, and is headed in on the central cross track and moves forward to the erecting shop. It is then lifted high in air by the 100-ton crane and carried over others in the shop to the pit upon which it is to stand. Here the stripping process is begun. The parts as they are taken down are placed in a huge iron basket which stands on the track behind the pit in the 18 ft. strip, to which we referred, and which is claimed by the machine shop. This basket full of parts is carried by the crane to the central cross track, over which is moves to the spaces on either side of the turntable, where it is lowered into cleaning vats, and sunk in a liquid which eats off the grease and dirt in short order.

RAILROAD MAKING IN THE WOODS.

The basket when drawn up out of this vat is placed so that each part can be sent at once to the machines where the first repair operation is performed. As each article is completed it moves to the appropriate space behind its own engine.

All the tools are electrically driven, those in the heavy machine department each by a separate motor, the light machines are groop driven. The Crocker-Wheeler Company have furnished the necessary electric equipment. The heating and ventilating system has been put in by the Buffalo Forge Co., and is such that in the winter warm air is blown into the shop through a number of pipes, placed at regular intervals, and in the summer cool air is supplied in a similar manner. The power house and store house stand on the erecting shop side of the establishment, and are so placed that when the car shops are built, (the foundations of which are laid), both store and power house will be in a central position for the distribution of material, and of compressed air and electricity to all portions of the plant. The foundations for the air compressors and dynamos are very heavy, solid masonry piers, extending about 18 ft. below the floor level of the power house. The boiler room is supplied with link-belt conveyors for ashes and coal, and a chain grate mechanical stoker feeds the furnaces.

In the smithy the Buffalo Forge Company's down draft forges are to be seen, so that smoke will be unknown in the blacksmiths' shop. Two large Acme bulldosers are at present in place in this shop.

In the matter of smoke disposal the erecting shop is decidedly up to date. When it is necessary to fire up a boiler for testing or other purposes, a galvanized iron pipe with easy curve, leading from the smoke stack to the floor, is put on by the crane. A cover plate in the floor is removed and this at once connects the galvanized iron pipe with a long tube running the full length of the shop, which terminates in an exhauster, and not only draws all the smoke out of the shop, but enables the engine to be "fired up" from cold water in about one hour and thirty minutes. The time-honored custom of filling a whole shop with a murky cloud because one boiler has to be tested is a thing of the past at Collinwood.

The entire equipment in the shops is new, only one or two of the most modern tools from the old shop in Cleveland have been considered of sufficient capacity to find a place on the floor of a shop which has been stocked with the best and latest designs from the works of the leading machine tool makers of the United States. It was humorously said that some of the most skilled machinists in the company's employ have been for a time at a loss to grasp some of the modern refinements in machine design or capacity which our leading tool makers have been able to develop in that commercial rivalry in which all are engaged, and which means the "survival of the fittest" in the highly specialized work now required by a prosperous, busy, dividend-paying workshop, such as that of the Lake Shore and Michigan Southern.

That superb equipment and carefully designed shop facilities are not the "be all and end all" of shop economics, is evidenced by a study of this company's methods. The Lake Shore people intend that what has been provided, shall be worked to the very best advantage. For that purpose they intend to introduce a new system in the erecting shop, which for want of a better name may be called the "house building" system. It is briefly this: A certain number of erecting shop pits are to be placed under charge of a gang foreman. This gang foreman will be held responsible for expeditious work on his pits. He will have men to strip engines and handle material, but when the erecting work comes on, he will receive visits from certain gangs, who will do certain work all over the shop, and do it all the time. He will, when required, have the gang work for him, who have handled all the wheels in the shop, another gang will do the boiler mounting work, still an-

RAILROAD MAKING IN THE WOODS.

other gang will put up piping, another will equip the engine with air brakes, another will set the valves, and so on. Each gang will do its own work always and all the time all over the shop. The gang boss will arrange with the general foreman as to when certain kinds of work will be done. While on his pits, he will be the master of each gang, but when they go their way, he will know them no more for the time. The system is as if one had a house to build, and should know when to get the lathers in, when the plasterers, the gas fitters, the paper hangers, the painters, etc. No set of artisans should interfere with one another, none should the various gangs. The determining if a suggestion is good or bad will rest with him. If good, he is to have drawings made and submitted to the master mechanic, if approved, he will get the "rig" made and put in operation and report upon its degree of excellence. He might perhaps be called the "shop-kink expert," though a more appropriate title may be decided upon. The point is, however, that the Lake Shore people are in the market, so to speak, for "brains," and the man who shows he has some will be recognized. That is another way of being "up to date," and perhaps one which in the long run will help pay dividends, 4 1-6 round trips between the earth and the moon. In all these years no passenger riding behind it has suffered any accident. It has been out of service only 12 per cent. of its time and has cost for maintenance 1.28d. per mile run. It has in twenty years burned 27,486 tons of coal, or 32 pounds per mile, and has evaporated 204,711 tons of water. It has made 186 odd trips as occasion required, and early in August it completed 5,312 round trips between Manchester and London, and so is probably qualified to tell a "tale of two cities" in its own steady-going fashion. The trains pulled are very light.

RAILROAD MAKING IN THE WILD WOODS.

be too early, and so become idle, and none too late. At Collinwood sufficient gangs to handle the work will be provided, but the gang boss will have to see that the required material for each has been got ready, and that each gang works without hindrance. Each doing its quota, and moving on, steadily, regularly, quickly and economically. In this way maximum output will be secured without fuss, rush or delay.

A new functionary will also be put in charge of a very important feature of work all through the shop. He has no definite name at present. His duty will be to look into all suggestions for tools, rigs or appliances for expeditiously doing work, suggested by machinists or members of which is what the mechanical department officials of the Lake Shore and Michigan Southern have in view just now.

An "Uncommercial Traveller."

A very notable engine on the London and North-Western Railway has just completed twenty years of active service. The "Charles Dickens" was turned out of the company's shops at Crewe in 1882, and is well known to persons who travel between Manchester and London. During the time it has been on the road it has made two million miles, which, compared with the average in England of 20,000 miles per year, equals 100 years of service. The mileage made amounts to

Things Left in Cars.

Scotch people are reputed to be very careful in clinging to their possessions, but there must be many exceptions if we are to judge by a report recently published by the Glasgow Tramway Corporation. The report says:

It is interesting to note that during the year 7,258 articles were left on cars, of which 1,162 were umbrellas, 814 bags, 294 baskets, 725 parcels of clothing, 577 purses, 16 watches, and 32 sums of money. The articles claimed at the tramway office numbered 4,235, and the remainder were sent to the Central Police Office. The owners of American cars do not bother the police to look after the articles left in any of their cars.

The Future Engineer.

"Are we taking the right course to educate the coming engineer to that state of efficiency at which he must arrive in order to become useful as well as ornamental?" so spoke Mr. F. W. Dyer at a recent meeting of the North-West Railway Club. The usual course, he said, is to make engineers out of wipers. Neatness is one of the qualifications of an engineer. Is the pit the place to inculcate neatness in the future engineer? Wiping is not conducive to neatness; a man surrounded by filth soon becomes accustomed to it. The wiper also comes in close contact with the fireman and his ear is open to all this worthy may say in disparagement of the engine and things in general, and may let ignorant prejudice rule his actions when promoted to the position of fireman.

The speaker proposed that only those be promoted as firemen who have had at least one year's experience as helper to a roundhouse machinist. He believed the future engineer should learn how an engine was constructed by jacking up engines, taking off steam-chest covers, taking down rods, dissecting air-brake pumps, and, in fact, every portion of the engine that is dissected in a roundhouse. This would certainly give a helper an opportunity to learn a great deal about an engine in one year. When he became an engineer he would know how to report work advantageously, as well as know how to fix up a disabled engine.

We understand that the Southern Pacific Railway Company, in connection with the Rock Island, has adopted the Consolidated "Axle Light" system of electric lights and fans for electrically lighting and ventilating all the new cars to constitute the "Golden Gate Limited," which goes into service between Chicago and California in November. This is the same system of electric car lighting that is used on the "Twentieth Century Limited" of the New York Central & Lake Shore, the "Pennsylvania Limited" and on the best trains of many other leading railway lines, as well as on all private Pullman cars. One of the advantages of the "Axle Light" system is that each car carries its own lighting apparatus, making its own electricity as it moves, with the power taken from the revolving car axle and storing up sufficient electricity in batteries underneath the car to keep it illuminated while stationary, so that, no matter if the car should be detached from the main train and sent to some other point, it is always electrically lighted.

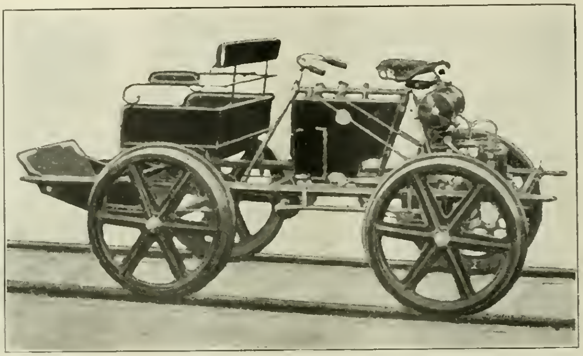
A New Hollow Staybolt.

A new form of hollow staybolt has been designed by a fireman on the B. & O., Mr. J. D. Shaeffer. The stay is in the form of a short, hollow, conical tube, the smaller end being a solid blunt point about the usual staybolt size and threaded. The larger end may be any desired diameter, though 2 in. is the preferred size. The hole in the inside sheet of the firebox is to be cut to receive the larger end. A copper ring is placed over the tube before its insertion, and when the stay is screwed home in the outer sheet the copper ring covers the joint between cone and sheet. The larger end is then rolled, and flanged down over the ring and the smaller end is riveted in the usual way. This form of hollow stay is intended to provide increased heating surface.

The Horse's Mistake.

He was only an old gray plug—a Pittsburg cab-horse of long experience. Many years ago he spent his colthood on a Butler county farm, in a large green pasture where grew pretty fresh ferns and sweet-scented, bright-colored flowers. That was long ago, and was only a memory now; and although the dirty cobble-stones and smutty bricks of Pittsburg had been his only scenery for thirty odd years, the bright colors and sweet scents of the pasture were still his in memory. He stood dozing by the curb at the foot of the steps leading up into Carnegie Hall. The beautiful pasture memories were doubtless the theme of his day-dream.

One of the Air Brake Convention ladies, accompanied by two others and wearing a spring hat of wondrous millinery design and resplendant colors, came jauntily down the steps from the organ recital on her way to her carriage. She unsuspectingly approached dangerously near the dozing cab-horse. His eyes suddenly opened wide at the sight of the bright flowers on the lady's hat as did his nostrils to her perfume of violets or wild rose. Instantly he became a transformed creature. His drooping head rose high. The old bent knees straightened out and the curve left his backbone. He was a colt again in his native pasture, as he gazed out of the corner of his eye at the approaching hat and the flowers were his. One quick bite with his old, yellow, dull teeth put the flowers in his mouth and jerked the hat from the lady's head. She screamed, and the hat fell to the curb from where it was rescued, a little disordered, by one of her companions. "It was the bright-colored flowers that did it," said one companion sympathizingly. "No, it was her perfume," said the other. "I don't care what it was," replied the lady, looking ruefully at the damaged hat. "I've half a mind to cry, anyway." The old horse looked sheepish. The lady looked—well, very angry, indeed.



A ROAD INSPECTION AUTOMOBILE.

Internal Combustion Motor for Railways.

In a small way the oil motor is invading the domain of steam, a car for track inspection purposes having been constructed by Mr. F. R. Simms, principal of the Simms Manufacturing Co., Ltd., London. The motor is of 7 h.p. and is capable of propelling the car at a speed up to 30 miles an hour, its stock of fuel, which may be either gasoline or kerosene, being sufficient for 200 miles. The motor is fitted with the Simms-Bosch magneto electric ignition gear by means of which, and constant level fuel feed, the action is entirely automatic. The transmission is by gear of Panhard type, giving three speeds up to the maximum, either backward of forward. This form of vehicle will probably find a sphere of usefulness soon.

A smaller vehicle for the same purpose is doing good service in South Africa on the Sir Lawry's Pass and Caledon line. It was built by De Dion-Bouton, Ltd., of London, and is fitted with one of their 3 1-2-h.p. water-cooled motors, which is capable of maintaining a speed of 20 miles an hour.

The makers of American hand cars might find a useful suggestion in this one.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Combined Automatic and Straight Air-Brake.

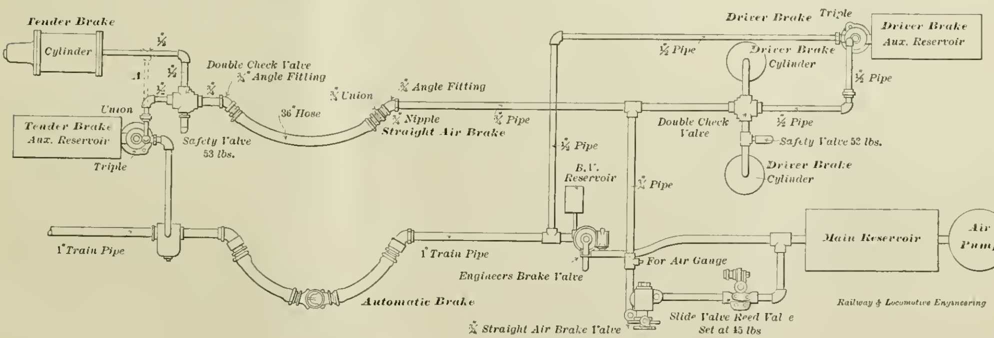
The combined automatic and straight air-brake which we illustrate herewith, is a device containing much merit. As will be seen, and as its name implies, the combined brake is a double brake, containing both the straight air and automatic features. It was originally designed for switch engines whose peculiar work required them to handle trains made up and equipped with automatic brakes, and also to do switching in the yards, where the straight air brake is more serviceable.

The automatic brake has never been thoroughly satisfactory for switch engine service, inasmuch that its application is indirect and tardy and the release is somewhat slow. The breaking power cannot be increased or diminished as readily as it can with the straight air brake. Therefore the straight air brake is much more preferable for switch engine service than the automatic.

Recently the combined automatic and straight air brake has found its way into a new field not originally designed for it, and has proven itself very satisfactory. This new field is in long freight train service where it is desirable to hold the slack of the train bunched during a release or slow down of the train, so there will be no jerk, due to the head brakes releasing while the rear brakes remain set.

Still another field in which it has proved itself useful is that of mountain service, where the straight air brake on the engine and tender may be held applied, steadying and holding the speed of the train, while the brakes on the cars are recharging. In this service the new device has made itself valuable indeed, and has rendered possible the handling of trains with air brakes on exceedingly steep grades where it was formerly impossible to do it without the assistance of hand brakes.

As will be seen from the illustration, the device is quite simple. To operate it, both brakes should be cut in and kept ready for either kind of an application. When the automatic brake is used, the straight air brake valve should be left in release position. When using the straight air brake the automatic brake valve should he left in running position. There is no cutting in or cutting out of either brake when it is desired to use the other, the double check valves in the pipe to the brake cylinders being automatic in their action. When the straight air brake is applied, the double check will automatically close communication to the automatic brake. When the automatic brake is used, the double check valve will again automatically close, cutting out the straight air brake. This device is even now doing good work on a number of roads, promises to be quite extensively used, not only for switching service, for which it was originally designed, but for long freight train work and also work on heavy mountain grades.



COMBINED AUTOMATIC AND STRAIGHT AIR-BRAKE.

Why Not a Power Brake?

We have been appealed to by a correspondent to agitate the question of an extra motorman on the street cars of New York and Brooklyn in order that greater protection may be given to persons crossing the streets. Our correspondent complains that numbers of people, and especially children, are yearly injured by the inability of the motorman to operate both his controller and hand-brake, and at the same time to keep a lookout on the track ahead.

Doubtless there is sufficient occasion for the complaint of this correspondent; but rather than supply an extra man to ride on the forward platform of the ordinary streets car to merely apply the hand-brake, it would seem much better to equip the car with power brakes. Inasmuch that power brakes are so rapidly coming into general use for street cars, it would seem that more attention should be given to this subject. While the suggested remedy of our correspondent would not seem the best one available, still it all goes to prove the inadequacy of hand brakes for street cars in congested cities and the need of power brakes for that class of service.

Two Air Pump Stories.

The marked superiority of the 9 1-2-in. pump over the 8-in., when the former came into the air brake field several years ago, was greatly pleasing to railroad men in general. Particularly was the feature of greater capacity valued, as air-braked freight trains were then beginning to become quite long. One engineer on the Southern Pacific in California, however, failed to appreciate greater capacity and found a grievance against the 9 1-2-in. pump which he reported on the work book as follows: "New 9 1-2-in. pump jams more wind than three 8-in. pumps. But take it off! It leaves the air, on my side of the engine, so thin and makes my asthma so bad I can't breathe. Put it on the left hand side, or take the d—n thing off altogether."

Now that the 11-in. pump has been ap-

plied to some few engines, a story has been found for it. A Santa Fe engineer at Argentine, Kan., had an engine with a 9 1-2-in. pump, and was coupled to eighty cars of air, whose train line was leaking a little worse than usual. He had been pumping about ten minutes and had gotten only a few pounds. His pump was tearing along like a race horse. Beside him, on the next track, was a new Schenectady engine with an 11-in. pump and

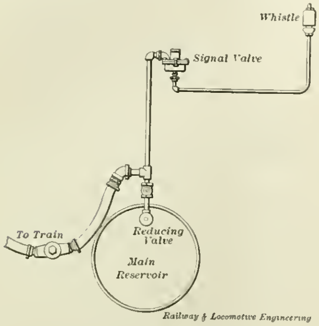


FIG. 1.—SIGNAL PIPING.

coupled to eighty-six air cars with train line in fairly good condition.

With a dull "choom! choom! choom!" as leisurely and lazily as the step of a railroad tramp on a hot day, the 11-in. stroked for about five minutes and then shut down with 90 and 70 in the main reservoir and train line, respectively. The engineer looked fiercely at the

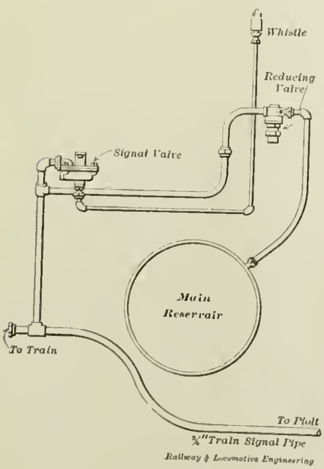


FIG. 3.- SIGNAL PIPING.

11-in. pump resting quietly after finishing its work, and then turned around to his 9-in., which was still racing, and was smoking at the packing nuts. Suddenly a thought struck him, and he ran forward and called to the switchman:

"Hey! there—you, Jim! throw that switch, and let me pull up a few car lengths! Let me get away from this d—n 11-in. pump. It has sucked up all the air around here and I can't' get any. Let me pull up to where it is thicker and fresh! D—n the 11-in. pump—when you haven't got it!"

Arrangement of Piping for Signaling Apparatus.

Briefly stated, the principle of the air signaling apparatus is to make a quick, sharp discharge at any of the several car discharge valves in the train. This discharge produces a reduction of pressure in the train line, and all the air in the line, from the foremost point to leave its own immediate position and travel toward the point where the discharge was made and where the pressure is lowest. The air on top of the rubber diaphragm in the signaling valve being pipe line air, will reduce in pressure the same as at any other point in the pipe. This permits the undisturbed pressure on the under side of the diaphram to raise it up and cause a blast at the whistle.

The supply of pressure to recharge the whistle line must come from the main reservoir, through the reducing valve. It is important, therefore, that the reducing valve be so located that it will not interfere with the reduction made in the signal line before that reduction reaches the signal valve, or else it will annul the reduction and there will be no blast at the whistle. The sketches herewith show four of the principal methods used in putting up piping for the air signaling device on locomotives.

Fig. 1 is the first and oldest style. There is no pilot pipe in this arrangement. The reducing valve is too near the signal line pipe, and could, with a longer pipe to the signal valve, intercept the reduction made back in the train before it reaches the signal valve. With this method of piping the first blast might follow, but the second and third would not, unless their reductions were quite heavy and the train short.

Fig. 2 is the next method. With it the signal would respond if the reduction was made in the train behind the tender, but might not if the train was ahead of the pilot.

Fig. 3 is the proper method of piping, where the main reservoir is under the foot board of the cab. This arrangement will give an equally good blast of the whistle regardless of whether the reduction be made back of the tender or ahead of the pilot.

Fig. 4 is the best arrangement, where the main reservoir is ahead of the firebox, and, like the arrangement shown in Fig. 3, the whistle will blow equally well, whether the train be back of the tender or ahead of the pilot.

Automatic Driver Brake Retainer.

This device, illustrated herewith, is intended to keep the train bunched after the train brakes have been released, in order to prevent the shock to the train on the second application of the brakes, and also to prevent the train from possible breaking in two, when the train brakes have been released, caused by the forward end of the train surging ahead, while brakes are not fully released on

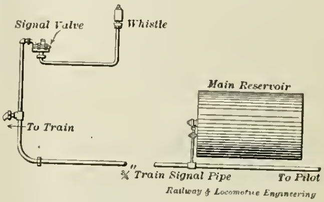


FIG. 2.—SIGNAL PIPING.

rear end. It is made to do its work from the movement of the brake valve handle, instead of turning up and down the handle of the ordinary pressure retainer by hand. D is the weighted retaining valve, C the cock which opens and closes the free outlet of the pipe, B its handle, and A the extension of the brake valve handle.

The retainer is connected to the brake valve handle, and is operated by its movement. The pressure is retained in the driver brake cylinder when the brake valve handle is in full release position, and released when the brake valve handle is in running position.

When the brake valve is brought to full release, the handle should be left in said position until all brakes on the train have been released. In this position 15 pounds of pressure is held in the drive brake cylinder, which keeps the train bunched.

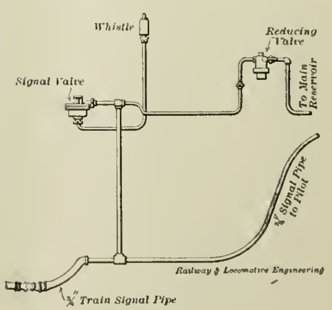
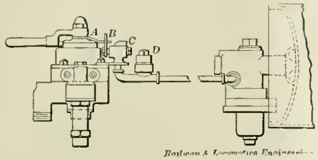


FIG. 4.—SIGNAL PIPING.

In the event of making an application of brakes, and it is not desired to come to a stop, the brake valve can be brought to full release and returned to running position, which will release all brakes, including the driver brake.

Emergency Tests of Air Brakes.

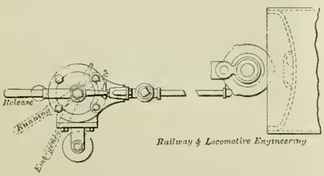
After reading the article in October issue of LOCOMOTIVE ENGINEERING on the "Emergency Test of Air Brakes," by E. G. Desoe, I am inclined to somewhat differ with him. Of course, if the emergency application is made at terminals in



AUTOMATIC DRIVER BRAKE RETAINING VALVE.

the ordinary testing of the brakes as well as the service application, we will always be sure that the train pipe is practically wide open all the way through. This test will insure the operation of the quick action parts, just as he says it will.

It has been my experience that the stop cocks work shut or partly shut very seldom in service; but nevertheless it would take but one nearly closed cock



AUTOMATIC DRIVER BRAKE RETAINING VALVE.

to render the quick action feature inoperative. The foundation brake gear is plenty strong enough for the usual service operations of the brakes and for an occasional emergency application, but I doubt very much if it is strong enough to stand very long the continued strain of emergency tests of the brake at terminals, such as Mr. Desoe advocates. Is not the emergency feature of the triple valve certain enough that we will not need to make a test of it each time with a service test?

It has been my experience that a partly closed angle cock will not generally sufficiently retard the flow of air pressure in the train pipe to prevent quick action. I think the examination of the ordinary train in operation will disclose the fact that you will find in the train a number of angle cocks which are no more than three-quarters open, and yet it is possible to get an emergency application of the brakes. I have gotten the emergency application on cars where the angle cock was only half open. But, of course, all cocks should be wide open; but would not the better plan be to take additional pains when making up the train and see that the cocks are all open, instead of carelessly making up the train and then making an emergency application to prove that all cocks are open. I believe care in making up the train is much better, and it would not be so expensive on rods, levers, and emergency parts of the triple as the method Mr. Desoe proposes.

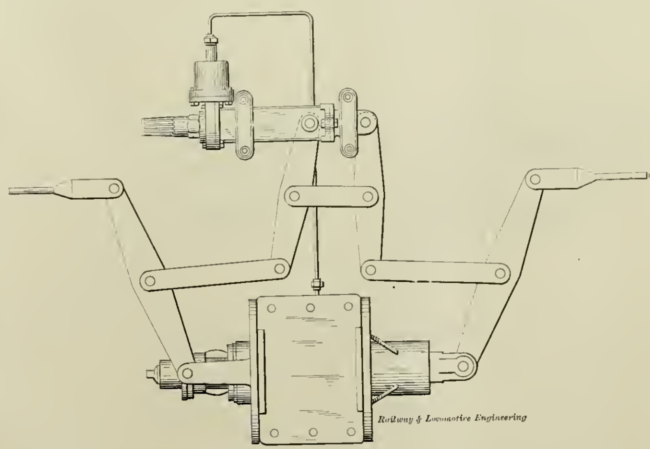
OTTO BEST,
Gen'l A. B. Inspr., N. C. & St. L. Ry.
Nashville, Tenn.

Drivers Sliding with Engine Reversed.

It has appeared in your paper several times, and air brake men know it generally, that it is harder to slide a wheel at high speed than when the train is nearly stopped. It is also claimed that the engine should not be reversed when the driver brake is set, as that will slide the drivers.

Now, suppose we are running along fifty miles an hour, and discover a rock or something on the track ahead and want to make the shortest stop possible. The speed of your train is high and just then it is about impossible to slide wheels when you set your brakes. Why not help make the stop quicker by reversing the engine until your speed comes down to twenty miles an hour, say, and then throw her ahead again before the speed gets slower where the danger of wheel sliding begins? This would make a shorter stop and wouldn't slide the drivers. I would like to know if any of your readers have tried this.

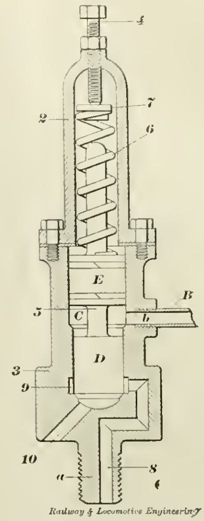
ALBERT M. JONES.
Southern Ry.
Atlanta, Ga.



PROPOSED SLACK ADJUSTER ARRANGEMENT FOR PASSENGER BRAKE.

The Silvene Retaining and Release Valve.

The purpose of the present invention is the provision of a relief valve for the air cylinders of automatic brake mechanism, which will be self-acting and quickly respond to the variation in pressure of the air in the train pipe, so as to quickly relieve or bleed the cylinder when it is desired to release the brakes so that the latter will be quick in their releasing action.



SILVENE RETAINING AND RELEASE VALVE.

With these ends in view the invention consists essentially of a release valve, embodying in its construction two pistons of differential areas, comprising between their opposing ends a chamber which is in communication with the train pipe, the smaller piston closing two passages, the one leading to the brake cylinder, the other to the outer air.

The improvement consists essentially of the novel features and the combination of the parts which hereinafter will be more

fully described and claimed and which are shown in the annexed drawing, which is a vertical central section of a valve constructed in accordance with and embodying the essential principles of the invention.

The valve case is composed of two parts, 2 and 3, which are secured together by bolts or other fastenings, passing through the opposing flange ends. The upper part, 2, is closed at the other end, which end is centrally apertured and internally threaded to receive a set screw, 4. The lower part, 3, is provided with a nipple, *a*, by means of which communication is had with the brake cylinder and with a lateral opening, *b*, which makes connection with the train pipe, *B*. The upper part of the bore of the part 3 is larger than the lower part of the said bore and between the two is provided a chamber, *C*, which is about opposite the opening, *b*. Two pistons, *E* and *D*, are connected or form part of a valve stem, 5, which latter is projected into the chamber formed in the part 2, and receives a coiled spring, 6, which is confined between the piston, *E*, and a flanged nut, 7, held in engagement with the inner end of the set screw, 4. The two pistons, *D* and *E*, are in axial alignment and fit steam tight within their respective bores.

The passage, 8, is provided in the nipple and communicates with the brake cylinder, but extends vertically through the lower portion of the part 3 and communicates with an annular chamber, 9. A relief passage, 10, leads from the chamber, 9, and is designed to carry off the spent air from the brake cylinder when it is desired to release the brakes. The piston, *D*, is constructed to close the passages 8 and 10 at the proper time, so as to prevent the escape of the air when the brakes are applied.

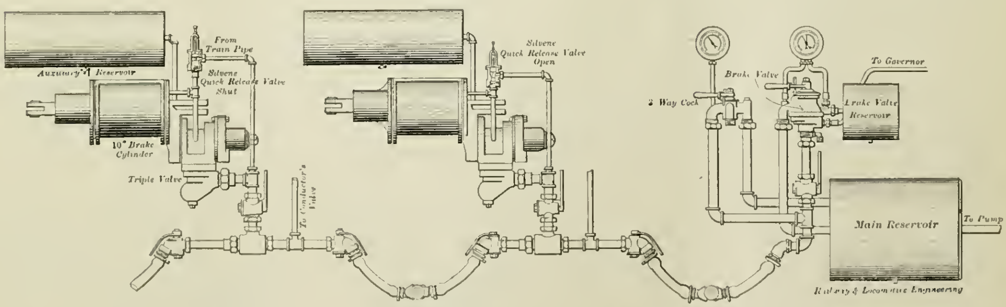
The operation of the invention is as follows: The opening, *b*, as herein stated, is connected with a train pipe, the air pressure within which is usually about 70 pounds. The set screw, 4, is adjusted to create a forward pressure on the piston, *E*, through the spring 6 of say, about 20 pounds. Under normal conditions the upward pressure on the piston, *E*, is about 61.85 pounds, and on the piston, *D*, plus the twenty pounds pressure of the spring 6, sixty pounds. Hence it will be seen that the upward pressure is in excess of the downward pressure by about 1.85, and therefore the pistons *E* and *D* will occupy the highest position, leaving the passages 8 and 10 open. On the application of the brakes the pressure in the train pipe is reduced and the upward pressure on the piston *E* will be about 53.01 and the downward pressure on the piston *D*, 35.24 plus 20 pounds, the pressure of the spring, or a total of 55.24 pounds. It will be seen that the downward pressure exceeds the upward, hence the pistons will move downward and close the passages 8 and 10, during the time that the brakes are applied. When the pressure in the train pipe assumes its normal condition the upward pressure will again exceed the downward pressure, and the pistons *D* and *E* will quickly reverse their position and uncover the passages 8 and 10 and permit the bleeding of the brake cylinder. It will be observed that the valve is wholly automatic in its action and that the position of the pistons depends solely upon the pressure in the train pipe.

Figure 1 will show the way to charge and recharge the train pipe. Suppose the train pipe was at 70 pounds pressure, and Figure 1 set at 74 pounds, and the engineer made a reduction of 9 pounds, you would then have 19 pounds in the brake cylinder. If the engineer wishes to take 5 pounds pressure off the brake cylinder, he would recharge the train pipe with 4 pounds pressure, through the three-way cock, and at the same time the 4 pounds pressure comes out through the three-way cock, and Figure 1 will close the exhaust port, still leaving 14 pounds pressure in the brake cylinder with the train pipe recharged. When the engineer wants to release his brakes he puts 4 pounds in the train pipe and keeps it on about 10 seconds. If he should find some brakes stuck he would hold the 4 pounds pressure longer.

Figure 1 would make a good retaining valve for the driving brake and tender brake. Yours truly,

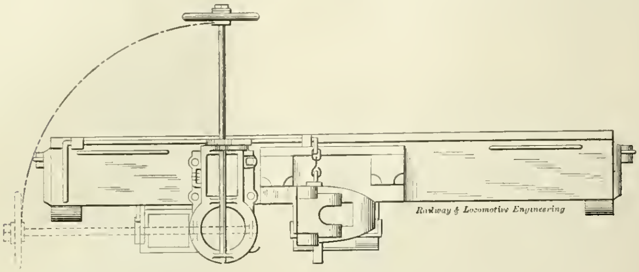
TONY SILVENE.

Victoria, B. C.



LOCOMOTIVE AND CAR ARRANGEMENT OF THE SILVENE RELEASE AND RETAINING VALVE.

An Improved Hand Brake.



IMPROVED HAND BRAKE FOR FLAT CARS.

I have invented certain new and useful improvements in brake-stands for cars. My invention relates to brake-stands for railway cars, the same residing particularly in a novel means of mounting the brake-staff whereby it may be swung from a vertical to a horizontal position without throwing it out of operative connection with the brakes.

In the loading of freight cars, it is frequently found necessary or desirable to have the load project beyond one or both

ends of the car, and as the brake-staffs are ordinarily located at the ends of the car, it is necessary to disconnect the same, and thereby render it impossible to operate the hand brake. By my invention I provide for simply changing the position of the brake-staff when it is desirable to have the load project beyond the end of the car, so that the same is out of the way, but is still capable of throwing the hand brake into operation.

John W. Plunkett.

Manchester, Va.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(202) E. R. B., Baltimore, Md., writes:

What would happen if the small port in the steam valve at the governor was to stop up? A.—It would make no difference so far as the operation of the pump is concerned, except that the condensation would be liable to accumulate and freeze in the pump.

(203) A. M. J., Atlanta, Ga., asks:

How many different kinds of Westinghouse air pumps has there been made? A.—Including experimental pumps, there have been quite a number made; but regular commercial air pumps, that is, pumps for steam locomotives, have been confined to four kinds, which are, 6-in., 8-in., 9 1-2-in., and 11-in.

(204) A. M. J., Atlanta, Ga., asks:

Does the Westinghouse people make other kinds of air pumps than those for engines? A.—Yes, they make motor driven pumps, and also axle driven pumps for electric cars. They also supply air pumps of the 8-in. and 9 1-2-in. kinds, with larger steam or air cylinders, for all kinds of work requiring very low or very high air pressures.

(205) E. R. B., Baltimore, Md., writes:

What is the small port through the steam valve of the air pump governor for? A.—This small port permits live steam to pass into the pump when the steam valve has been closed by the operative parts of the governor, and keeps the pump moving slowly, thereby preventing condensation of the steam and the settling of water which is liable to freeze up in cold weather.

(206) D. J. McC., Savannah, Ga., writes:

I am aware that as the brake shoes wear out, the piston travel on that car will increase. How much is this increase? A.—The increased piston travel will vary according to the leverage on the car. On cars where the leverage is high, that is, where the power is multiplied between the brake cylinder and the brake shoes, say ten or twelve times, the increase in piston travel will be twice as great as on a car whose leverage is only five or six; that is, increases five or six times through the leverage.

(207) O. H. B., Dayton, O., writes:

I have noticed a number of metal brake beams which are bent at that point just inside of where the brake shoe head is fastened to the beam. Does this indicate a weakness at that particular point in the beam? A.—Not always. Sometimes the stepping block on the rail in track sheds and stations are of such a form and so located that when a car is backed up into the sheds and against this block, the block will strike the beam at that point, producing the bend, and virtually ruining the beam. Sometimes the beam is structurally weak at this point.

(208) E. R. B., Baltimore, Md., writes:

(1) How much of a figure does the engine truck brake really cut in a train of six or seven cars? (2) Have any tests been actually made and data obtained on this point? A.—(1) Yes, quite a number of reliable tests have been made, and all go to show the superior advantages of the truck brake. One of the actual stops which has been made with an engine, tender and six cars, 70-pound train pipe pressure, was made a few years ago on the Pennsylvania Railroad at Ship Road, Pa. The data for this stop is as follows. Speed, 60 miles per hour. Level track. Coaches braked to 90 per cent. of their light weight; tender braked to 90 per cent. of its light weight, and engine equipped with forward truck brake and driver brake. On a level grade the stop with the engine and truck brake both cut in was 1,514 ft. Without the truck brake the stop was made in 1,612 ft. This proves the truck brake to be a very material advantage.

(209) C. J. M., Reading, Pa., writes:

On some of our passenger engines the signal whistle will blow when the cord is pulled if the engine is running forward, pulling its train, but will not blow if the engine is running backward, pulling the train. A.—The cause of this is doubtless due to the fact that the engine complained of has the old style of signal piping, in which a branch pipe leaves the signal pipe near the main reservoir, which is back of the cylinder saddles and between the frames, to connect with the reducing valve. Further back another branch pipe leads to the signal valve. This arrangement places the reducer nearer to the car discharge valve when the engine is backing up, and the reduction made in the pipe is absorbed while passing the branch to the reducing valve and before it reaches the signal valve. When the engine is running forward, the reduction in the signal pipe first affects the signal valve, which responds as it should, and does not give the reducing valve a chance to operate until after the whistle valve does its work.

(210) T. L. B., Boston, Mass., writes:

Is there any special retaining valve for driver brakes to hold in the slack in the train when making a stop, and then releasing, that is reliable and will do its work? I have been using an ordinary 15-lb. retaining valve on my engine to hold the slack in and keep the train bunched, but it seems too light and does not hold all of the slack in. It seems to me that a heavier valve of this kind could be used to give better results. Possibly some air brake men that you know of are using another kind of a retaining valve that will do the work better. A.—The 15-lb. retaining valve has been used by a number of air brake men and others on driver brakes, but the general complaint seems to be that they do not hold enough, that a large part at the slack runs out and produces a jerk. The best thing we know of is the new Westinghouse straight air attachment to the automatic brake on the engine, which holds the driver brake set on the engine, while the slack is held in the train, and also keeps the engine brakes set while the train brakes are recharging on grades. Several roads are using the device and speak loudly in praise of it.

(211) T. S. W., New Zealand.

I am running a Baldwin engine. Class W. D., 6-wheel coupled, 4-wheel Bogie, under training end, and single-wheel Bogie under leading end. When I am coupled to a train of about 40 wagons, and when I make a service application of from 10 to 15 lbs. reduction, and the train stops, it always stops with a jerk, as if the brakes are set on rear end, and allows the front portion to run, causing it to stop with a sudden jerk. On the engine no jerk is felt, but by the guard in rear end there is. Train is fitted with Westinghouse quick action triples. Every brake is working throughout the train. I may also state I have no trouble from any jerk when I have from 15 to 20 wagons. It is only when I have between 20 and 40 wagons on. Could you kindly explain the cause? I carry 65 lbs. in the train pipe and 100 lbs. in the main reservoir. A.—It would be better to hold the brakes set until the train is brought to a standstill. A retaining valve on your driver brake, to hold the slack bunched, would probably give you good service. Or, better still, the new Westinghouse combined straight air-automatic brake, illustrated and described elsewhere in this department, would prevent your trouble.

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What Tonnage Rating Really Is.

If a locomotive were coupled up to a steel cable, which passed over a pulley and down a well, the draw-bar pull minus the friction of the pulley would be represented by the weight it could draw up out of the well, when working on level track. This would be measured in tons. When the locomotive is coupled up to a train, this same draw-bar pull is all it can exert. If the cars were attached to the cable, the weight which the engine drew up out of the well, would haul the train toward the mouth of the well. This is draw-bar pull, and it is spoken of as being so many tons.

A car standing on a level track weighs perhaps 20 tons. There are 5 tons carried by each axle, and 5 tons is then said to be the "axle load." This 20-ton car does not require anything like a pull of 20 tons to move it along the track. It is not being lifted out of a well. Draw-bar pull, and train weight, are not interchangeable terms. They mean very different things, but they are related in a certain way, as will appear later.

Whatever it takes to move the car, one would expect that two cars would require twice as much pull to move them, and so on. Theoretically this is true, but in practice on the road, a long train introduces conditions not present with a short train. In passing over grades and round curves, long trains behave differently to short ones, because a long train may, on occasion, bind on three or four curves at the same time, or it may have the greater part of its length on two up grades at once, and only a short central portion on a down grade. These conditions seriously affect the engine's ability to get the long train over the road. Mere length of train, then, must be acknowledged as a factor in the real problem of hauling cars.

Another factor is that of axle load. For any given weight of train, the fewer the axles the load rests on, the better for the engine. It has been proved by experiment, that an engine capable of hauling, as a maximum, 700 tons total weight of train, distributed in 10 cars of 70 tons each, cannot haul the same total weight when distributed in 70 cars of 10 tons each. It does not matter to the engine how much of the 700 tons may be tare, and how much, paying load, but what does matter, and what the engine plainly shows by stalling, that it feels, is that the first mentioned 700 tons hauled, stood on 40 axles, and the last 700 tons not hauled, was borne by 280 axles. Therefore for any given load, the fewer axles which have to be turned, against journal and wheel flange friction, the better. The large car is intended to shorten the train and increase the axle load. It is the business of operating officials to see that out of the total weight resting on any series of axles, the great bulk of it ought to be revenue load. The engine has only its draw-bar pull to give, and if a railway company uses up most of that in turning a multitude of axles, spread out so that curves and grades begin to add their quota of extra resistance, then such a road must be content with less paying freight moved. It is simply a question of how best to utilize the known draw-bar pull. Enginemen are beginning to understand that A may pull 700 tons in 10 cars, while B cannot pull 700 tons in 70 cars, and further, that B cannot justly be held to blame for his failure to get over the road, under the circumstances.

Just here a curious feature of the case comes in. The load of 700 tons is the weight of a train as weighed on track scales. If the weight of the next train be 700 tons, but distributed in more than ten cars, the engine will most certainly feel it. If carried in less than 10 cars the engine will as surely have power to spare. When you say that an engine can pull 700 tons gross load behind the tender, you either mean that the weight is in some definite train of known make up, or else you are not giving any more information than you did years ago, by saying "Seventeen loads is her train."

Mr. J. M. Daly, superintendent of transportation of the Illinois Central, has devised a train resistance computer, in which these factors, length of train, and composition of train, are both taken into account. He first finds by dynamometer test, over a division, with known grades and curves, what an engine will haul, using 40-ton gross load cars as a basis. If an engine using its maximum power can pull a train of 25 cars, each 40 gross tons, over a division within the schedule time allowance, its rating is 1,000 tons. That is simply translating draw-bar pull into definite terms of train weight and make up—not weight alone but weight and make up together. You don't need to know the actual figures for the draw-bar pull now, there it is turned into weight and make up. All that is required is to give that particular kind of train to that particular engine every day, or find its exact equivalent. Simple equality of weight will not do at all, because the "make up" scores heavily in train resistance. It cannot safely be ignored. The engine in question was, after trial, rated at 1,000 tons gross weight, but it will never pull exactly 1,000 tons gross weight, in all the rest of its life, unless you give it 25 cars of 40 tons gross weight, in good weather. All the other perfectly equivalent trains which it will haul, might with propriety be called trains of "made up weight." That expression is derived from "weight" and "make up," the two necessary factors.

In order to get the correct equivalent to the 40-ton test train, or the "made up weight" for 1,000 tons rating, Mr. Daly has wooden blocks, made out of type wood, such as printers use, cut along the grain, so they do not alter their lengths with heat and cold, or with moisture or dryness. Each block is marked for gross weight of a car. The length of each block represents the gross weight of a car and something more, for the resistance of that weight on 4 axles. That is W + X, where X is the "make up" factor. These blocks put in a groove beside the scale give the equivalent train or "made up weight" which the engine can haul. On the scale, beyond the 800-ton mark the divisions are reduced 10 per cent. for mere length of train resistance after the 1,200-ton mark, a further contraction of 20 per cent. is made for the same reason, mention of which has already been made.

In Mr. Daly's cabinet, when you know the engine rating, fill up the groove with blocks marked with the gross tonage of the cars you have, and the size of the blocks and the length of the scale automatically takes care of the "make up." You can prove that, by adding up the weights of the cars, and you will not find that the total is the same as the test train, unless you have that test train duplicated. For bad weather, a set of scales on an octagonal roller, show percentages off standard rating, which may be deter-

mined by the officer in charge. Just fill up with blocks to the given figure, and the full draw-bar pull is provided for every time by a combination of weight and make up, whether the cars are heavy or light, or the train long or short.

Railway Companies as Manufacturers.

In nearly all countries that have made decided progress in arts and manufactures, the railway companies maintain workshops where their machinery is made. In Great Britain the railway companies make not only their locomotives and cars, but they undertake to make everything required for their use, from a steel rail to a telegraph instrument. The policy pursued by those companies is to secure for themselves the profits of manufacture that would go to private firms were the latter required to supply the goods used by the railway companies. The theory of producing appliances under the companies' own officials at the lowest possible cost is all right; but it does not work out as the promoters desire. A manufacturer for self-protection and for self-survival must manage his business to finish appliances at the least possible cost, and to do so he must use the best kind of tools, employ the best skill in the market and have these supervised by the ablest and most progressive superintendents that can be procured.

We believe that in Europe where railway companies are the manufacturers of their own appliances, the work costs much more than it does in the United States, where nearly everything needed by railroad companies is bought in the open market under free competition. Where railway companies have become manufacturers, there is a strong impetus to continue manufacturers, and to extend their operations, for all the officials concerned are interested in magnifying their own importance by the association connected with great workshops whose productions appeal to the imagination of people not accustomed to analyze the cost of mechanical operations. Sub-division in production operations has been carried out more thoroughly in the United States than in any other country, and the extraordinarily low cost of production for which our manufacturers are noted is due in a great measure to this system. Manufacturing at the least possible cost calls for the employment of specialists at the head of every department, aided by specialists as assistants. This is the developed system of industrial production in the United States. What we have seen of railway manufacturers in Europe we conclude that those in control think that a first-class works manager in charge covers the requirements of all departments.

As a matter of fact the works manager is not sufficiently transcendent in grasp to wisely select the foreman or superintendent of such diverse industries as rolling steel rails and the manufacture of telegraph instruments. If the railway companies operating immense manufacturing establishments would or could keep the expenses of each department absolutely separate, they would soon discover that safety valves, injectors and brake mechanism could be bought more cheaply in the open market than they could be manufactured by the railway company. There is no keen inducement pushing upon the officials who are in charge of railway workshops to introduce the very latest method and the most approved tools for doing work cheaply. They have no rival manufacturer threatening to undersell them, and the cost of production is a very uncertain quantity. There are rumors in circulation every few months that American capitalists have obtained control of some important British railway, and that the intention is to operate it on the same methods as American railroads are managed. People who talk of Americanizing the operating of a European railway do not understand what they are talking about. They can form no idea of the stupendous difficulties that would be encountered in changing foreign to American methods of train service, or the systems of operating terminals. But the manufacturing establishments would be less difficult to manage. If American capitalists were to obtain control of the London & Northwestern Railway it is certain that one of the first moves made would be the reducing the huge workshops at Crewe to the capacity required for repairs and sufficient new work to regulate the work of the repairing forces.

We have been led to enter upon this old discussion of "the advisability of railroad companies building their own rolling stock," because we have come across a great many newspaper articles lately, in which assertions were made that certain railroad companies are about to enter the field as manufacturers of their own machinery. The assertions are hardly worth contradicting, because the influences which move their leading railroad directors to wish that they were in a position to build their own cars and locomotives, are the influences which would prevent them from maintaining a well-equipped, well-manned manufacturing establishment. They are all intensely embarrassed through scarcity of cars to carry the freight which is so abundant and of locomotives to haul them, which can be neither bought nor hired, and in their distress they exclaim, let us provide the means of building our own machinery. A manufacturing establishment does not grow up in a night like Jonah's gourd, and by the time workshops could be put in operation the inevitable panic would come on and the manufacturing establishment would be starved out of existence to meet the retrenchment demands of the Wall street gamblers. And so history would repeat itself.

If the leading railroad companies, who are now so dreadfully embarrassed for want of power and cars, had displayed moderate business providence when hard times came, the depression would have been greatly mitigated, hundreds of workmen who were thrown out of employment would have made a livelihood, and the railroad companies would not now be suffering.

Wages Paid on French Railways.

We frequently receive letters from correspondents asking about the prospects of railway men in foreign countries. We always answer that the condition of railway men is better in America than it is in any other country. In this connection we think extracts from a report made by the American consul at Paris will be of interest:

The total number of employees was: Managers and clerks, 3,076; traffic department, 116,227; locomotive and rolling stock, 74,248; road and buildings, 75,177; making a total of 268,728, of whom 26,754 were women.

The salaries of the officials and workmen do not rule high and are regulated more by the time a man has been in the employ of the company than by the kind of work he is called on to perform, except, of course, in the case of skilled artisans. Moreover, salaries vary greatly, not only on different railroads, but often on the same line. Thus, the Orleans Railroad divides its lines into seven sections, and a plate layer employed in the second section (Department of the Seine et Oise and the district round Paris) will receive $248 a year, whereas, if at work in the seventh section (Tarn and Haute Loire Departments), where living is very much cheaper, he would get only $187 per annum.

It is therefore difficult to give exact figures, but it may be estimated that an ordinary porter receives $21.55 a month, a head porter $25.33, a pointsman from $25.77 to $28.06, and a plate layer $18.50. The driver of a locomotive earns on an average $36 per month, and his "rewards" for saving coal, etc., usually amount to $14. Stockers receive about $25 per month, with $5.50 as extras. A foreman in the workshops earns as much as $48.50 per month, an ordinary workman $19.30, and an apprentice $14.

Of the 71,273 men working on the principal railroads, 8,651 receive from $13.70 to $16.40 a month; 22,573 from $16.59 to $21.23; 17,592 from $21.42 to $26.05; 11,038 from $26.25 to $21.84;

3,407 from $32.04 to $35.70; 2,680 from $35.90 to $43.42; 1,899 from $43.62 to $53.07; 2,171 from $53.27 to $72.37; and 267 receive more than $72.37—that is to say, 56 per cent. of the men receive from $16.59 to $26.05 per month, and 84 per cent. get from $13.70 to $31.84 per month.

The men work, on an average, twenty-eight and one-half days per month, and from seven to twelve hours a day. Nearly 15 per cent. of the men are lodged.

On the six principal railroads (Ouest, Est, Paris-Lyons-Méditerranée, Orleans, Nord, Midi) there are 15,319 women. They are employed to keep the gates at level crossings, and receive a very small —almost a nominal—salary; but each woman has a cottage (generally with a little garden) rent free. According to the official returns, the women work twenty-eight or thirty days a month, and from ten to fifteen hours per day, but as a matter of fact their duties only occupy them a few minutes at rare intervals (for where the traffic is great, men are employed) and they have plenty of time to look after their household affairs. Not infrequently, the female gate keeper is married to a porter or plate layer, and her small earnings and house help to eke out his wages. Of these 15,319 women, 5,275 receive not more than $2.90 per month; 7,700 receive from $2.90 to $4.80; 1,680 get from $4.82 to $7.72; and 601 from $7.91 to $10.61.

Only sixty women get higher wages than this, and there are only five who receive from $26.25 to $31.84 per month.

Smoke in New York City.

New York city is remarkably free from the disfiguring effect produced by smoke on buildings and on everything exposed to the weather, and the people are so proud of this condition that they began a vigorous crusade against those who created a nuisance by burning soft coal during the strike of the anthracite coal miners. The health authorities were particularly severe with the elevated railroad company, which burned soft coal in their locomotives very unskilfully. To judge from the appearance of the engines, the firemen had received no instruction as to how soft coal could be burned with the least possible generation of smoke, and most of the engines seemed to be doing their best to paint the atmosphere black.

Some factories and boiler users in New York city use bituminous coal all the time, and cause no nuisance from smoke, because their furnaces are fed with automatic stokers which supply the fuel just as it is needed and constantly keep up a high furnace temperature. When people who had been accustomed to burn hard coal were suddenly deprived of the supply, and were compelled to resort to soft coal, they nearly all found themselves under the ban of the health inspectors, and many of them were prosecuted in the courts. A skilful fireman can, with care, fire a common furnace with little smoke nuisance, if it is not chronically forced, but the ordinary run of stationary boiler firemen are not skilful and the result was that a cloud of smoke hung over New York as long as the scarcity of hard coal continued.

It is too much to expect that every steam-making boiler when using soft coal should be equipped with an automatic stoker, but it is not too much to demand that they be attended by a good fireman and provided with smoke preventing appliances which cost little. The places that cause the greatest nuisance with black smoke are small plants where the fireman has a great many duties to perform besides that of attending to the furnace. When he gets to the boiler room he throws into the furnace enough coal to keep it going until he does a lot of other work, and in the meantime the fire keeps converting a great part of the fresh coal into smoke which becomes very much in evidence at the top of the chimney and over the surrounding houses. The fire hardly gets time to burn bright when the fireman returns and smothers it again with fresh coal, and so the process of smoke-making is kept up. People responsible for smoke produced in this way deserve no mercy from the public censurators of health.

Library of Modern Engineering Practice.

Every ambitious engineer wishes to have a good reference library of Engineering Practice, but very few works of reference are anything more than a source of annoying disappointment. The leading aim of people who publish encyclopedias is to make money with the least possible effort, and their works contain a mass of obsolete matter that tires a seeker after information to wade through. We have recently enjoyed the privilege of examining a Reference Library of Modern Engineering Practice, as it is called, which was a refreshing change from the stereotyped collection of ancient encyclopedia scrap that most reference books are compiled from. The Reference Library in question consists of ten volumes published by the American School of Correspondence of the Armour Institute of Technology, Chicago, the editor-in-chief being Frank W. Gunsaulus. Every article in the volumes, as far as we can make out, is composed of new and original matter, up to date in every respect. It forms a series of exhaustive treatises on the multitude of subjects treated without tiresome verbosity or sterile brevity. The engineering student may depend on finding in the book all he wishes to know on any subject without a haystack of padding. The special purpose of the "library" is for the instruction of the students of the American School of Correspondence, but we suppose that any one can purchase it. It certainly ought to be in every engineer's library.

"Materials of Machines." By Albert W. Smith, Professor of Mechanical Engineering in the Leland Stanford Junior University, California. Publishers, John Wiley & Sons, New York, 1902. Price, $1.00.

This little book of 142 pages, neatly bound in cloth, is illustrated with 17 figures, all line engravings. The book is designed to place practical information in concise form before the man who has to select materials for machine parts. There are five chapters in all, the first of which is an outline of the metallurgy of iron and steel. In this chapter the various forms of furnaces and ores, the various kinds of processes used to make iron and steel are shortly and clearly set forth. Following this is a chapter on testing and stren—strain diagrams, in which the rationale of testing is explained. The next chapter, devoted to consideration of cast iron, gives composition, properties, methods of making, and explains how cast iron is "chilled," and the effect of cooling besides much other information of the same character. Wrought iron and steel is also very well covered in the succeeding chapter. The book concludes with a consideration of alloys and some very useful observations are made on the composition of the various parts of a steam engine. Altogether the book is readable, concise and up to date, and though not an exhaustive treatise on the subject, contains much valuable matter for those whose occupation or interest leads them to the study of the metallurgy of iron and steel.

The Professor on Shipboard.

A very attractive way of writing up valuable information on various subjects is putting the matter into story form. *Marine Engineering*, New York, has been for some months running a sort of story called "The Professor on Shipboard," and it is now published in book form, price $1.00.

Briefly told, the story is of a college professor of engineering, who has many excellent ideas, some of which are rather theoretical, who makes the trip to Brazil and back with his brother, who is Chief Engineer of a steamship, and who has had much practical experience. The discussions bring out some strong points which will deeply interest every man who has anything to do with a steam plant. We heartily commend the book.

The gross earnings of the Chicago Great Western Railway (Maple Leaf Route) for the third week in September, 1902, show an increase of $6,086.55 over the corresponding week of last year.

Sharp Practice by Book Agents.

About three years ago a book was published by a Chicago firm called "The Story of the Erie," which we handled to some extent, the contents of which is familiar to many of our readers. This was an expensive book, costing $7.50, when sold by ordinary dealers like ourselves, but the publishers put it into the hands of skilful and by no means scrupulous book agents, who went about the Erie R. R., selling it for $25.00, on time payments. A good many of the employees of the Erie were induced to subscribe for the book at the high price named. Some of them found out that the book was not what it was reputed to be, and a combination was formed among the engineers at Chicago to fight the publishers. Many of those concerned refused to pay for the book, and their wages were garnisheed on account of the obligation incurred.

The case lately came before the courts on complaint of Engineer Alfred B. Jager, and it has been decided in his favor, and the garnishee vacated. It looks as if this will make a final decision against the publishers and that they will be unable to impose its payment on account of the so-called subscription slips obtained by the agents. There are many other concerns canvassing railroad employees for the sale of expensive books whose actions are worthy of investigation. If a book is so expensive that a buyer cannot make the purchase without giving an order on his pay he ought to wait until he is able to buy on a cash basis.

Scarcity of Cars and Locomotives.

The question which is most prominently before the officials in charge of railroads to-day, is how are we going to secure cars and locomotives sufficient to transport the immense fall business in sight. All the car and locomotive building works have orders that cannot be completed for over a year, and there is no other means of getting the railway machinery required. for the railroad shops are going to be kept beyond their capacity in effecting repairs. We find from numerous newspaper reports that reach us, covering the whole country, that complaints of shortness of cars are prevalent in every state of the Union, and Canada does not appear to be any better off. This was the state of affairs before the increase of coal transportation, due to the closing of the great strike, will affect the railroads. With all parts of the country demanding a coal supply, and at the same time expecting the prompt movement of their ordinary business, besides the regular "grain rush" in the fall will give the railroad managers a problem in railroad transportation to work out, such as they have never been tried with before.

QUESTIONS ANSWERED.

(163) A. D. P. asks:

How is the heating surface of a locomotive boiler calculated? A.—Heating surface is the name applied to the aggregate of all those portions of the boiler which are exposed either to flame or the action of the heated gases due to combustion. The heating surface is made up of the area of fire-box side sheets, the crown sheet, the fire door sheet, the back flue sheet (this latter minus the total area of all the flue holes), and the total area of all the tubes, the outside surface or that exposed to the water being used in the calculation. The front tube sheet is not considered as part of the heating surface.

(164) L. H. asks:

What is the action of a lifting injector? A.—The action of a lifting injector is briefly, that when steam is admitted a partial vacuum is created between the injector itself and the water level in the tank, which is below that at which the injector is placed. The lifting injector does not lift the water at all in the usual sense of those words; it removes part of the air pressure from the supply pipe and the water in the tank rises through this pipe just as water in a well rises in the pipe of a suction pump. The water thus "lifted" is forced into the boiler in the usual way by passing through the combining tube of the injector. The flow of water to a non-lifting injector is by gravity.

(165) L. I. D. writes:

I was running about 25 to 30 miles an hour, light engine, a switch engine, small wheel backing up. I shut off steam quickly and dropped lever in the corner immediately afterward. The same instant I knocked out back cylinder head on left side, piston rod sheered off at the crosshead, guide was torn from cylinder and entirely gone; so was piston; the guide bearer from boiler was bent around rocker arm and the arm bent back, the valve-stem rod was broken off and gone. The main rod was split from one end to the other and bent out. Question, what caused the fracture? The engine was just out of shop. A.—We believe that a nut, bolt or other substance passed through the back steam port into the cylinder. We, however, would like the views of our readers.

(166) L. C. C. asks:

What is the difference in effect, by using a long, narrow steam port from that obtained with a short, wide one? A.—The long, narrow steam port admits steam rapidly at the beginning of valve opening, but has the disadvantage of wire drawing the steam. Long, narrow steam ports, if deep, greatly retard the exit of exhaust steam, which is a serious matter. Locomotives constructed with steam ports of the usual width but very long, are generally wasteful in the use of coal and water. Such ports give quick steam admission without wire drawing, but necessitate excessive clearance and a larger and heavier valve. English engines probably owe some of their superiority over American engines in the matter of fuel consumption to the fact that the rule across the water is to use ports perhaps 25 per cent. less than those which are standard here.

(167) M. P. P. writes to know which is most perfectly balanced, an outside admission or an inside admission piston valve? A.—Usually the inside admission piston valve is the more perfectly balanced because the stem running through the center makes the area of the heads exactly alike. The outside admission valve has the area of the valve rod less on one head for steam pressure to act on, than the other. If the valve stem is extended through the front cover, the balance is as perfect as with the inside admission valve.

Is there any advantage in the use of one kind of piston valve over another? A.—The inside admission valve, in addition to perfect balance, is not so hard on valve stem packing for the reason that the packing is only subjected to the intermittent action of exhaust steam, which is at a pressure much less than that of live steam from the boiler.

(168) J. E. S., Butte, Mont., writes:

I disconnected an engine on account of broken spider; engine had piston valves with end admission. Put valve in center of travel and clamped it by wedging in between valve stem and side of hole where it goes through guide yoke. Upon giving engine steam, valve would slowly move to end of steam-chest, sometimes to the front and sometimes to back end. The fact that it would move either way would indicate that the valve was well balanced, but why did it move at all? Valve was found to be O. K. when removed at shop. A.—The fact that the valve moved as described appears to us to be evidence that it was not exactly balanced, and that the clamping was not sufficient. The presence of the valve-rod at one end reduced the area upon which the steam pressure acted, as compared with the front end. and if fairly loose in the steam-chest, the valve might slowly move backward. If the chest was worn in the center when the rings of the front end came to the worn portion steam could escape into the exhaust cavity, and reducing the pressure sufficiently at front of the valve, allow it to move forward, until the conditions at first obtaining, recurred. and the valve slowly worked back again.

Trust in nothing but in Providence and your own efforts. Never separate the two.—*Bleak House.*

Consolidation Engine for Norwegian State Railways.

The 8-wheel connected locomotive here illustrated is one of a number at present being constructed at the Swiss works of Winterthur for the Norwegian State railroads and to the general conditions laid down by Henri Paul Hoff, the chief engineer of motive power. They are the largest and heaviest freight engines yet constructed for Norway, and embody several original features in their construction. There are two cylinders, compound, working in single expansion at the will of the engineer by means of a connection between the reversing gear and a special live-steam valve, and in such manner that at all cut-offs beyond 70 per cent. of the piston stroke this valve is opened automatically, whereas at lesser cut-offs it is closed by the reversing gear, and the machine then works compound. This device is an adaptation upon a well-known system, by the works of Winterthur, and appears to be very efficient in service.

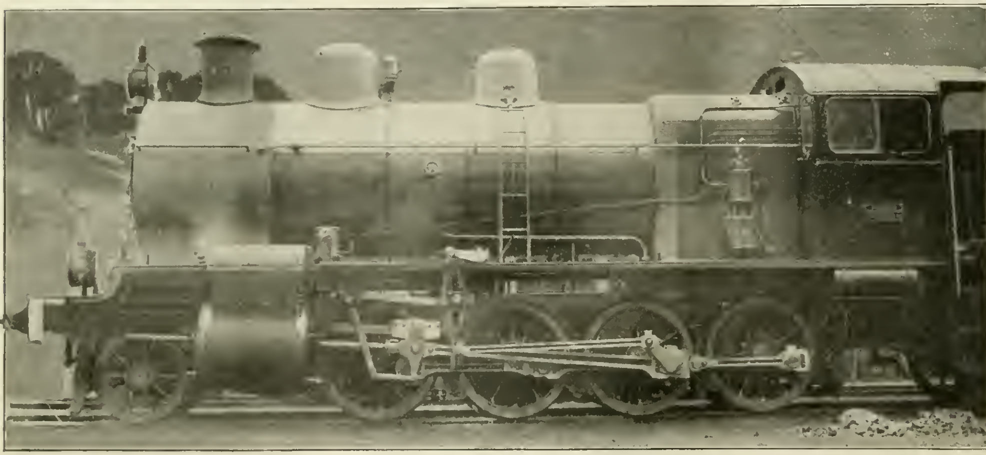
The slide valves are Von Borries,' balanced; the valve gear, Walschaerts'; the pistons are prolonged through the front covers to mitigate grooving of the cylinder; all the cylinder covers have safety valves; both the steam chests are fitted with air-valves, and the receiver has a combined air and relief valve; oiling of the valves and pistons is done by a force pump.

The whole of the motion and valve gear is designed with the end of obtaining great lightness with a maximum of strength. All the bearings are ample and well-proportioned and the valve movement is specially devised to avoid torsional strains. The blast pipe has a fixed nozzle and the smoke arch has the American form of spark-arrester. The wheel springs have equalizers connecting them —the balance-levers or yokes being hung upon the axlebox crowns in the American way. The lateral play of the second and fourth axles is 5-8 in. on each side and the driving pins of the latter allow, of course, for this movement in the bushes of the connecting side rods. The front Bissel truck allows a radial movement of 2 in., the recall of the axle being effected by means of springs and of inclined planes on the axle-boxes.

The inside fire-box is rectangular, spreading outward to the foundation ring. The smoke-box is not circular, but of horseshoe form, allowing plenty of room for cinders. It has a clean-out pipe below.

The engine is built and finished in admirable style and with a first-class equipment. Among these are two automatic oilers, one speed indicator, two safety valves, three Freedman injectors, United States gland packing, pneumatic sanders, and Westinghouse air brake.

The tender is carried upon two 4-wheel trucks with frames of the Norwegian diamond pattern.



A NORWEGIAN CONSOLIDATION ENGINE.

PRINCIPAL DIMENSIONS, ETC.

Cylinders, high pressure, 21⅝ in.
Low pressure, 32¼ in. Stroke, 25¼ in.
Wheels, driving, dia., 49⅛ in. Truck, 38⅝ in.
Driving wheel base, 13 ft. 8½ in.

Weights, under drivers	68 tons.
Weights, under pony	11 tons.
Total	79 tons.

Tender, loaded, 38.5 tons.
Boiler, pressure, 174½ lbs.
Tractive effort, maximum, 25,300 lbs.

Home Made Packing.

A prominent railway company in the West is now making all their valve-stem and piston-rod packing from a simple and uniform mixture of lead, block tin and antimony, in the proportion of 75, 15 and 10 parts, respectively. They are apparently satisfied with the results obtained. All scrap packing is available for use and finds its way to the melting pot in due time. Economy in production and satisfactory performance are the reasons given for the use of the "home-made" article.

Packing Rings Made to Wear Tight.

The Chicago & Northwestern Railway when manufacturing piston packing rings put a unique "finishing touch" on the work, by cutting about five or six grooves on the wearing surface of each ring, very much the same in size and depth as would be cut to make the screw thread on a three-quarter-inch bolt. These shallow grooves do not, however, form a thread, because if they did the ring would leak. The grooves are parallel and go all round the ring. The idea is that when rings so grooved are put in, they wear much more rapidly to a true bearing than packing rings which are not grooved, so that the piston wears "tight" earlier than it otherwise would.

The Illinois Car & Equipment Company, of Hegewisch, Ill., just outside of Chicago, has recently purchased a large amount of electrical apparatus, which will be used for the operation of wood turning machinery. An order on the Westinghouse Electric & Mfg. Co. included two 250-K.W. and one 200-K.W. two-phase alternators, together with a four-panel switchboard, and the following induction motors have been ordered and will be installed: two 100 H.P., five 75 H.P., and one 50 H.P.

General Correspondence.

Engineers and Machinists Wanted.

Please put a notice in your paper that machinists, boilermakers, blacksmiths, and engineers wishing to come to South America would do well by writing me. Wages for machinists, boilermakers and blacksmiths is $7.50 per day, silver; engineers on the valley $6.00, silver, on the mountain $300.00 silver per month. Exchange is about two for one, making it in gold about $3.50 for mechanics; $3.00 for engineers on the valley and $150 gold on the mountain. Overtime is paid at the rate of double time. Have them send references and state experience.

W. D. Holland, M. M.
Duran, Ecuador, South America.

File of Railway and Locomotive Engineering Appreciated.

James Francis, of Carbondale, Pa., writes:

I beg to advise you, in reply to your editorial notice pertaining to a complete set of Locomotive Engineer, etc., that I have in my bookcase a copy of every issue since January 1, 1888. These volumes are bound and valued at $25 each, but like anthracite coal, not for sale at that figure.

Over 4,000 Tons to a Single Engine.

A few weeks ago one of the New York Central's 95-ton compound consolidations, with a 6-ft. boiler, carrying 210 lbs. of steam, hauled a 108-cared freight train over the Mohawk division, a distance of 143 miles. Time consumed was eleven hours, or 660 minutes, which is an average of almost fifteen miles per hour. Counting in water stops, and the many other delays to be met with each trip, we can safely say that 20 miles per hour was maintained for much of the way by this Hercules.

We also find the Lehigh Valley putting 104 cars behind one throttle-valve; and the Santa Fe frequently coupling up 83 cars on her undulating trail and pulls them in a single train.

The New York Central's 108 cars came to four and a half thousand tons. Only a few years ago the handling of less than half this weight was considered extraordinary.

The Central's standard box measures 37 ft. outside, not including bumper or coupler; allowing 2 ft. between the ends of each car, we have 108 cars, each occupying 39 ft. of track space. The total length of this train, counting in the locomotive's wheel base and all, would then be 4,270 ft., which is approximately four-fifths of a mile—a length which no road could conveniently handle that did not provide separate tracks for passenger and freight service, as no sidings are built on such large measurements.

Of course it would be impossible for the locomotive to start the whole train at a time. But, allowing 2 in. of slack in each of the 108 couplers, we get 18 ft. of slack in the whole train—enough to break off all the cars back of, say, the fiftieth, one might imagine.

Beyond doubt this performance was a remarkably creditable one, and the locomotive's designer, Mr. A. M. Waitt, is to be most heartily congratulated.

It would be interesting to put the Santa Fe's new decapod, tipping the scales at 268,000 lbs.—about 40 tons heavier than the Central's engine, and having an extra pair of drivers, to say nothing of a 6-in. larger boiler—it would be interesting to put this heaviest and strongest locomotive in the world on the Mohawk Division's tracks of the New York Central & Hudson River, and see if she could raise the 2399's record, under similar conditions.

N. Y. City. A. P. Payson.

Left-Hand Locomotives.

A correspondent sends us the annexed cutting from a St. Louis paper and asks if we ever before heard of a left-handed locomotive. They are quite common abroad.

"A brewing concern here has recently placed in service two yard engines having the unusual feature of being operated from the left side, that being the engineer's side of the cab. This arrangement is made because of the fact that it is desired to have the engines "headed" in a certain direction, and in so doing the right side is on the outside of the great majority of curves at the plant, making it difficult for the engineman to receive signals in the usual manner. To obviate this difficulty the "left-handed" type was adopted. The engines are of a fairly heavy type, weighing 72 tons each, with tanks having a water capacity of 4,000 gallons."

The Canadian Pacific Railway, at its Montreal shops, is selling coal to employees at cost price. We do not know what the company paid for its coal, but two very important points are apparent in this arrangement. The railway, buying coal as it does in large quantities, can procure fuel at much less per ton, even in times of stress, than the "man in the street" can possibly do; and the men get enough coal without having to beg for it in small quantities from dealers.

Classification of Pennsylvania Locomotives.

In 1860, on the 1st of July, the Pennsylvania Railroad Company owned 211 locomotives. Of these 204 were serviceable and seven were condemned.

Although from the opening of the road in 1849, several engines had been rebuilt in the company's shops, still much of the original material remained in these rebuilt engines, and it was not until 1867 that a locomotive, entirely new in every part, was built by the company, and it was not until 1868 that a system of classification was adopted. During 1861-2-3-4-5-6 many engines were so thoroughly rebuilt and remodeled, that their original design almost entirely disappeared; yet in each one some portion of the original engine remained—notably in the rebuilt Ross Winans' "camels," several of which remained in service after 1880.

On these engines, while all else was new, the original dome was used with the original throttle valve. This dome, however, in the rebuilt engines was placed near the rear of the boiler, and the stem of the throttle on its top was united to the throttle lever in the cab by a long vertical bar hinged to a post in its center and this post fastened in the side of the dome.

When the classification system was first adopted, it was supposed that eight classes, known as A, B, CIII, CIV(ANTH), D, E, F and G, were ample to meet all the requirements of the service. But increased weight of freight cars with increased carrying capacity thereof, and a desire for faster and heavier passenger trains added new types of engines, until by 1896, the letters of the alphabet up to and including U were in use, with several modified types, known as BA; A, anthracite; CA; DE, etc.

About 1897 a new classification was adopted which will be readily understood by the following—the small "o's" representing truck and trailing wheels, and the large "O's" driving wheels. The dash indicates front of engine, the first letters, the name of the new classification, and the letters to the right the old classification.

A	OO –	Q and U.
B.	OOO—	F, H, M, Modified I.
C.	OOOO—	None yet built.
D.	OOoo—	A, A (anth), B, BA, CIII, CIV (anth), CA (anth), G, K, L, N, O, P, T.
E.	oOOoo—	No old ones of this type.
F.	OOOo—	
G.	OOOoo—	D, DE, E, and P.F.W. & C.Ry "X."
H.	OOOOo—	I, R, S.

The "Modified I," referred to under new classification letter B, is a consoli-

dation 20 by 24 inches cylinder, 50 in. drivers, weight 92,600 pounds, from which the rear pair of drivers and the single pair of truck wheels at the front have been removed, and a sloping tender substituted for the regular freight type: all to enable these engines to be used as shifters.

The following table will show the changes in types and additions thereto from July 1, 1860, to July 1, 1900, in periods of 20 years.

At July 1, 1880, the company's consecutive numbering under initial of P. R. R., extended from No. 1 to 954, inclusive. Of these, however, 97 were unfilled owing to the panic of 1873, having stopped work on orders calculated to occupy part of these numbers; and to a number of old engines having been retired from service or sold, and their numbers left unfilled.

Here is the comparative table:

Builders.	Number on road in 1860	1880	1900	Types
M W. Baldwin	100	298	211	Various
Wm. Norris	2	0	0	"
Norris Brothers	19	0	0	"
Seth Wilmarth	3	0	0	"
Smith & Perkins	15	0	0	"
Ross Winans	11	5	0	"
Lancaster Loco. Wks.	25	8	0	"
N. J. Loco. & Mach. Co.	3	4	0	"
Penna. R. R. Co	0	406	1,623	"
Norris Bros. (Lanc'r).	0	12	0	"
R Norris & Son	34	2	0	"
Jersey City Loco. Wks.	2	1	0	"
Rogers Loco. & Mach. Works	0	11	0	"
Pittsburg Loco Wks.	0	5	5	"
Danforth Cooke & Co.	0	19	0	"
Trenton Loco. & Mch. Works	0	2	0	"
Camden & Amboy R R.	0	32	0	"
Bel,. Del. R. R. Co.	0	19	0	Various
New Jersey Mfg. Co.	0	10	0	"
Rhode Is. Loco. Wks.	0	1	0	"
Stephenson (England)	0	1	0	"
N. J. R R. & Trans. Co.	0	21	0	"
Grant Loco. Works	0	0	8	"
Schenectady	0	0	1	"
Totals	211	857	1,848	
Vacant	0	97	0	
	211	954	1,848	

Of the company's classification the comparison is as follows:

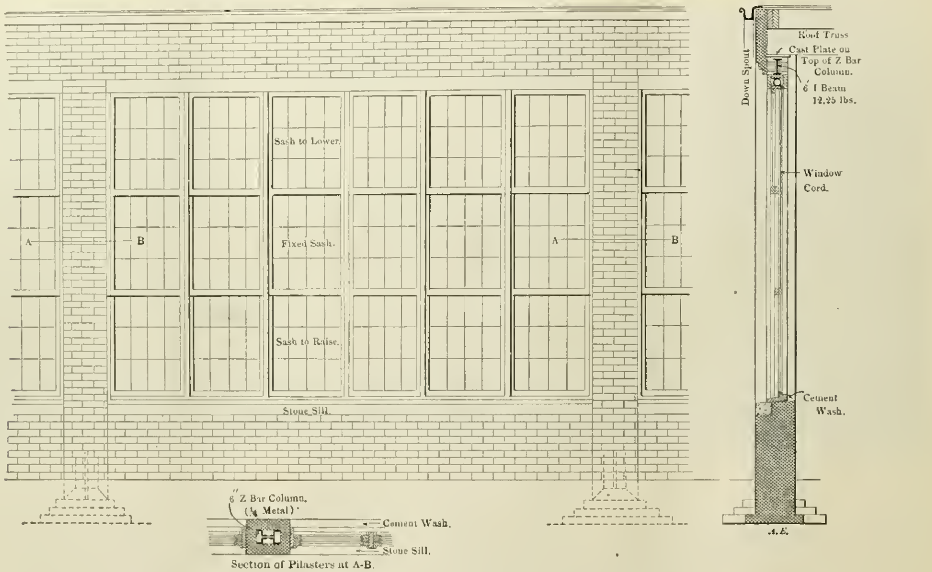
Class	In 1880	In 1900
A	15	0
A, anth	0	91
B	9	1
BA	0	10
CIII (Bit)	59	2
CIV (anth)	33	3
CA (anth)	0	10
D	167	1
DE	23	2
E	75	9
F	29	0
G	17	0
H	31	0
I	117	301
K	0	12
L	0	95
M	0	166
N	0	21
O	0	64
P	0	149
Q	0	27
R	0	613
S	0	0
T	0	1
U	0	37
Odd	282	2
Vacant Nos.	97	0
E1 new classes	0	3
E2 " "	0	1
F1 " "	0	37
Za " "	0	52
F2 " "	0	4
G4 " "	0	10
H5 new classes	0	15
H6 " "	0	109
	954	1,848

The present list of consecutive numbers is somewhat over 2,000, in addition to which are over 500 more engines numbered independently and marked with the initials of the N. C. R., P. W. & B. R. R., W. J. & S. R. R., and A. V. R. C. H. CARUTHER.

Yeadon, Pa.

Proposed Round House Construction.

At the last meeting of the American Railway Master Mechanics' Association, Mr. Forney said: "In past years I have had occasion to travel through the country and visit railroad shops in many places, and it seems as if the designers of railroad shops always took the greatest pains to exclude daylight."



LAWE'S PROPOSED NATURAL LIGHTING FOR ROUND HOUSES.

The criticism cannot be controverted. The writer has visited a number of shops on prominent railroads, and has observed that all are poorly lighted. Railroad shops, in this important feature, are far behind manufacturing shops. For example: The Chicago Ship Building Company's Machine Shop at South Chicago, Ill., is a model for imitation. Excepting the Monitor roof, the sides and roof are steel and glass, and paradoxical as it may seem, the light inside of the shop is better than it is outside; due, no doubt, to reflection, as all the machinery is painted white. This shop is a splendid example of what may be done to give adequate lighting.

The erecting shop of the steam engineering buildings, U. S. Navy Yard. New York, is also a fine example of a well-lighted building.

On railroads one of the buildings which should be designed with the largest window area possible, is the roundhouse. In busy times, the roundhouse is the most important shop; for it is then used as a combined repair shop for running repairs as well as for housing engines. Roundhouses, as a rule, are miserably provided with light. Each section usually has in the outside walls two windows, narrow and of small dimensions, and above the doors in the inner circle a few small windows. The work in roundhouses must be done promptly, and mechanics are handicapped from the beginning by being obliged to work with lamps in broad daylight.

The sketch here given shows a design for the outer walls of a roundhouse, in which the light is increased 350 per cent. beyond that of the ordinary roundhouse. The rod trusses rest upon Z-bar columns, which are inclosed, for fire-proofing, by brick work. The bricks, however, carry none of the weight of the roof. The brick work above the windows and between pilasters is carried by six-inch I-beams. The roof is wholly supported by the Z-bar columns and the six-inch I-beams serve to tie the Z-bar columns together and to carry the small amount of brick work above the windows. The top sash is balanced by the lower sash, affording in warm weather excellent ventilation—far beyond anything now in use. The writer furnishes the sketch to show how the increased lighting may be had. As the stock excuse is, when more window area is required, that the brick wall between the pilasters would be weakened, the plan here set forth will render such excuses void. T. A. Lawes,

Supt. M. P. and Machy., C. & E. I.
Danville, Ill.

After having advanced the pay of its machinists the Santa Fe has voluntarily increased the pay of its apprentices 11 cents per day.

The Alliance Machine Co.'s Plant.

Of the various enterprises that are rapidly coming to the front, favorable mention is made of the Alliance Machine Co., of Alliance, O. With the unprecedented demand for structural material it is little short of wonderful that the management was able to erect and complete its plant in so short a time.

The structure is entirely of brick and iron, 150 ft. wide and 400 ft. long. The erection of the building began April 10 of this year, and completed June 15. On June 24 all of the machinery was in place and in operation. The motive power is electricity, furnished from an Elwell-Parker motor, with a capacity of 275 rev., 250 volts, and 400 amps.

Each machine is of the latest and most improved design, driven by its own motor and furnished mostly by the well-known Niles Tool Works, of Hamilton, O.

The company makes a specialty of electric traveling cranes, any capacity; special electrically operated machines, rolling mill and special machinery, hydraulic riveters, flangers and punches.

ALLIANCE MACHINE COMPANY'S PLANT.

Ground will shortly be broken for a large foundry and they are now employing 250 men. Their present output, 2 cranes per week, they expect to increase to 6. They have already large orders from the Carnegie Steel Co., Bethlehem Steel Co., Am. S. & W. Co., and Colorado Fuel & Iron Co.

Mr. W. C. Whitehead, a prominent business man of Cleveland, is president; Mr. M. S. Milburn, a well-known banker of Alliance, is treasurer, and Mr. W. H. Purcell, who for years was the general superintendent of the Morgan Engineering Co., is the secretary and general manager. J. A. Baker.

The Hicks Locomotive and Car Works.

To follow up "lost motion" and eliminate it is the work of the F. M. Hicks Locomotive and Car Works, and the way it is done in these shops is very thorough. The company buys engines discarded in railway service, which have been replaced with those of heavier type, pays for them and takes them to their works at Chicago Heights, Ill., and there converts them into good rebuilt rolling stock, and gives them a new lease of life. The repaired engines and cars are then ready for sale, and they sell fast enough, as the activity of the works will prove. The company, or rather the firm, is not a new one, but the shops have, within the last year, been very much enlarged and improved, so that now the capacity of the plant is about 125 locomotives a year, about 125 coaches in the same time, and probably 10 freight cars a day.

The plant is situated on about 11 acres of ground, and has a principal building about 225 x 220 ft., containing the offices, storehouse, locomotive erecting shop and the machine shop. The pits run longitudinally and will eventually be served by electric cranes of from 15 to 25 tons capacity. Building No. 2, as the company call it, contains the boiler shop, the smithy and the power house, and is in floor area about 230 x 107 ft. In the power house are two Ball compound engines of 200 h.p., for running the dynamos. One Ingersoll-Sergeant air compressor of 1,000 cu. ft. capacity per minute, and a battery or three boilers, equipped with the Hawley down-draft system.

The tools in the machine shop are electrically driven, each one with separate motor.

There is between the locomotive department and the coach shop, a transfer table, now operated with compressed air, which will later on, be electrically equipped, and on the locomotive side of this table is a wide area used for storage of parts, etc.

The coach shop measures 197 x 170 ft. and will contain some wood-working machinery, while the upstairs floor is devoted to cabinet work and storage. A planning mill and wood working machine shop 126 x 70 ft. is separated from the coach shop by a small boiler and engine house which supplies power for the shops adjacent. This will shortly give way to electrical equipment. The freight car shop is 158 x 60 ft. and will also contain some wood working machinery, while an auxiliary train shed, 240 ft. long by 18 ft. wide, provides accommodation for the repairs to cars which in summer could be carried on out of doors. A modern dry kiln, 80 x 22 ft. completes the list of buildings.

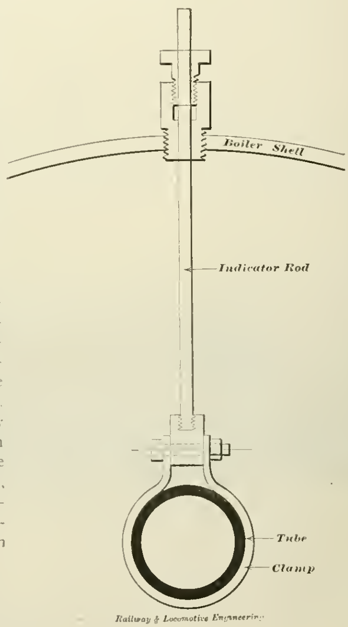
The object which the F. M. Hicks Locomotive and Car Works aims at, is to turn out good engines and cars from second hand material, and to make the engines modern, as far as they can be made. An engine when repaired is provided with a new wooden cab of ample proportions; air brakes, pneumatic sander, and other modern equipment is applied, and special attention is given to boiler and fire-box work. No patches are put on any fire-box sheet, and if two new sheets have to be provided, a new fire-box is put in, stayed in accordance with the original design of the boiler. The Hicks people state that they have an unbroken record without failure of fire-box or boiler attributable to either new or repair work, done by them. Grates, smoke boxes and stacks are modernized, broken or defective castings or wheels are renewed, and the entire engine is overhauled, even more carefully than it would be in the "back shop" of some of our leading railways.

Mr. Hicks has been able to supply serviceable box cars, thoroughly repaired with rainproof roofs, flats and gondolas to railways upon which the rush of fall business has found somewhat unprepared. A very satisfactory private car can generally be obtained from this firm at moderate figures, because partly damaged Pullman or other high class coaches are constantly purchased, and the interior completely remodeled according to the blue print furnished by the subsequent buyer. The Brunswick & Birmingham Railway have ordered such a car. The Oregon Short Line are having one made. The Fort Smith & Western are being supplied, and the El Paso & Southwestern Railway have received a very handsomely finished private car early in October from this firm.

Long Tubes Do Not Vibrate.

A very interesting experiment concerning tubes has lately been made on one of the Prairie type, fast passenger engines of the Lake Shore & Michigan Southern Railway. The engine in question, No. 661, belongs to class "J," and is one of a number of 2-6-2 engines designed by Mr. Marshall when he was superintendent of motive power of the L. S. & M. S. These engines are magnificent steamers, and have wide fire-boxes, with 2 1-4-in. tubes, 19 ft. 6 in. long. There has been some trouble experienced, however, in keeping these tubes tight, and one theory which it was desirable to establish as true, or to disprove altogether, was contained in the question, Do tubes of this length vibrate sufficiently in service to "work" at the ends and so leak?

In order to determine the facts in the case, Mr. S. K. Dickerson, the master mechanic at Collinwood, O., made an experiment which will be of interest to all railroad men, including those who since Mr. Marshall led the way, have used long tubes in locomotive design. Acting under instructions, Mr. B. F. Kuhn, general foreman, made the experiment. One of the top tubes was selected and immediately over its center a hole was drilled in the boiler shell, into which a plug with stuffing-box was screwed. The tube itself was tightly grasped by a band of iron 3-4 in. wide by 1-8 in. thick, the ends of which were bolted together with a filler between, much as an air brake hose clip clamps the rubber to the nipple. Into the small filling piece was tapped the end of an iron rod, which passed out through the plug with the stuffing box in the boiler



TEST FOR TUBE VIBRATION.

shell. The end of the rod projected above the top of the stuffing box, about a couple of inches, and when in normal position with steam on the engine, a gauge was made to correspond with the height of the projecting rod. Any vibration or deflection of the tube, would therefore be at once visible in the altered height of the projecting rod end. The tube itself being 19 ft. 6 in. long, had, of course, a slight normal deflection, due to its weight, but when the engine was working hard, the indicator rod was observed to sink down 3-16 of an inch, and to remain steadily in that position without vibration or tremor of any kind. As the engine was worked lighter, the indicator rod rose correspondingly, but in no case indicated any vibration of the tube in the boiler. When a stop was made at a station the indicator rod came up to normal. The stuffing box, all through the experiments, was adjusted loosely enough to leak steam so that the indicator rod could not possibly act as a stay or steady rest for the tube. The tube did not vibrate, but it sagged down in the center, the harder the engine was worked and tended to straighten itself out when the engine was worked lighter or came to rest.

The explanation of this action which the Lake Shore people give is that the tube naturally sags slightly in the center on account of its weight, and when the engine works hard, a greater quantity of heat passed into the tube in order to generate the larger volume of steam needed for climbing a grade or making up time, as the case may be. This greater amount of heat expanded the tube, and it being fixed at both ends and slightly sagged in the center, sagged still more, under the action of heat as indicated by the lowering of the top of the rod. They argue that had the tube been originally cambered, the indicator rod would have been pushed up when the engine was worked hard. They account for the tubes leaking by pointing to the greater work done by the tube in transmitting to the water the extra heat when the fire was forced and the general "punishment" sustained by all tubes when heavy work is being done.

At the conclusion of the experiment the rod was unscrewed, leaving the clamp on the tube, and the hole in the boiler shell was plugged.

"Precisely as Advertised."

Soon after one of the largest American railroads had been opened a traveler noticed a marked disregard for punctuality on the part of the officials, but he was interested in the country and made no complaint. At last the terminus was reached. There he met a beaming official of the company, who, pulling out his watch, said:

"Just look and see what time you make it, will you, please?"

"It wants 10 minutes to 1," said the traveler, a little puzzled.

"Yes, sir, 12.50 exactly! And that's the hour she's timed to arrive! How's that for promptness? Crossing the continent almost 3,000 miles, and getting here at 12.50 o'clock, precisely as advertised."

"I can't deny that, you know," said the traveler; "how many days were you late?"

"Oh, two or three, perhaps; but we struck the coast at 12.50."

Twelve representatives of the Brotherhood of Locomotive Engineers had a conference with General Superintendent Timmerman, of the Canadian Pacific Railway, last month upon the subject of grievances respecting running time and wages. The result of the conference is understood to have been satisfactory to both parties.

Engine That Hauled the Heaviest Train on Record.

The Lehigh Valley Railroad Consolidation engine No. 1102, built by the Baldwin Locomotive Works, has made a record in hauling cars which deserves being known by all readers of engineering literature. She left Sayre one day with 104 loaded cars, weighing 4,013 tons, and hauled them 82½ miles at an average speed of 15 miles an hour. The engine is a Vauclain Compound with cylinders 17 and 28 by 30. The boiler carries a working pressure of 200 pounds, and the diameter of the driving wheels is 62 inches, which gives a tractive power of about 50,000 pounds. The engine weighs 195,700 pounds, of which 171,000 pounds are on the drivers. The heating surface of the boiler is 2,973.7 square feet and the grate area is 76.33 square feet. We believe that the train of 104 cars was the heaviest on record ever hauled by one locomotive.

ENGINE THAT HAULED HEAVIEST TRAIN ON RECORD.

A Splendid Address from Robert Quayle.

Mr. Robert Quayle, Superintendent of Motive Power of the Chicago & Northwestern Railway, delivered a splendid address to the Traveling Engineers' Convention, held in Chicago September 9, 1902. He spoke in part as follows:

"I looked over the list of subjects this morning, and I find that you have most excellent subjects for the discussion, and I am impressed with the magnitude of your work. I am also impressed with the thought that you have put into this work in order that you may get for the railroads you represent the maximum result for the minimum expense.

"The railroads of this country are great, and they have helped to make this great city. From a small hamlet away back in 1837 this city has risen to the magnificent proportions of two millions in population, and the railroads have been no small factor in making Chicago what it is. But greater than the railroads are the men who run the railroads. Greater than any material, greater than any iron or steel rails, greater than any buildings, greater than any organization, is the brain that organizes, is the force that is in the man that builds, projects and runs the railroads in order that they not only get a profit, but that they may be run safely. You men are entitled to a good deal of credit, because of the fact that you are constantly leading the other men forward. You want them to have higher educational facilities. You want them to be better adapted to fill the positions that they hold. You want their moral standing elevated. And I pledge my word that in no organization, perhaps, outside of the church; in no business will we find to-day men whose moral standing is higher, who are freer from bad habits, particularly the drink habit, than are the railroad men of the United States. And to you, gentlemen, the delegates that come here in convention assembled, to you ought to be accredited some of the honor in lifting these men up to that position. It is true that the railroads to-day cannot afford to have men in their employ who are not straight. Here is a man going across the prairies sixty, seventy, eighty, ninety miles an hour, and you tell us that you go even faster than that, but we have records from the speed recorder that you frequently, night after night, on the railroad with which I am connected (and that is no exception; perhaps other roads make faster time), make seventy, eighty and ninety miles almost every night on the fast mail. Is it surprising at all that we need men there whose brains are clear, whose vision is keen, and whose nerves are steady? And even when they get the maximum speed, they still urge her on a mile more a little faster and faster, until they get everything out of that machine that is in it, and behind them are perhaps hundreds of passengers, human freight, depending upon that man at the throttle. Is it strange, I say, that the railroad companies must select from the ranks of their engineers the best talent, the best men in every particular, in order that they may accomplish this work?

I am glad to greet you this morning. I am glad to greet men who are thoughtful, who are earnest, who are constantly endeavoring to accomplish something. I look in this paper here, and I find one of the first subjects you have to discuss is the "Best Method of Drafting Locomotives." That suggests to my mind the varying conditions you have to do with. You have locomotives burning 250 pounds of coal per foot of grate per hour. You want to know just how much oxygen is and at what rate, to produce a proper combustion. No wonder you have to come into convention to discuss these matters and know how best to adapt the front end of the locomotive in order that you may not burn one pound of coal more than is necessary.

Ladies, if you were to take just as much interest in your household affairs, planning how to save this or that in order that you might make this $100 or $200 a month go in the household, as your husbands do on the railroad how they may save one pound of coal, you would have a whole lot in the bank.

"The next subject is 'What Qualifications Should a Man Possess to Fill the Position of Engine Inspector?' Now, I take it that means the roundhouse inspector. He should be a keen observer, His brain should be working while his eye is looking into things. He should be looking around carefully. I don't know but that is the kind of man, after all, that makes a success in everything—the man that sees things. You men who are giving your attention to such questions of moment as you have written in this little pamphlet must see things and be intensely in earnest; and the man who goes around listening to a wheel to see if there is a crack in it must not be listening to somebody cracking a joke. He must get the ring. If it rings out clear he knows it is all right, but if it has a dull sound he looks to see if the brakes are applied. A man who does not look

is not fit to be an inspector. A good inspector looks carefully at everything, because the safety of the men on the engine and the passengers depends upon the locomotive. It must be thoroughly examined and taken care of before it is taken out. The qualifications necessary for the engine inspector are brain, keen perception and intelligent thought to do his work well. And after all, gentlemen, isn't that the secret of success in life—the man who tries to make the most of what he does, in order to do it successfully? You take the fellow that doesn't care. He goes to the shop or the engine, waits until he gets to the end of the line and gets his engine on the sidetrack and goes home. You never see that man the General Superintendent or the Master Mechanic—never. He never rises any higher than the rut in which he is living. Get out of the rut, men, if any of you are in it. Make up your mind that you have got just as strong a character and intellect as any other man in the same business with you, and if you have not, make up your mind that you are going to have it from this day out. Make up your mind to do something, and then go to work and do it, and you will win.

"I don't know as I will touch very much on the air-brake business here. That is too big a subject. But a great deal can be saved to the company by the intelligent use and care of the brake.

"'What is the Best Method of Securing Complete and Intelligible Reports of Work Needed on an Engine to Fit Her for the Next Trip?' Well, that is easy. I am running an engine and have had trouble with something. The fellow in the roundhouse don't. The fellow that is going out on the engine after me doesn't; but probably he will before he gets twenty miles out, and he probably will get called in to tell what the trouble was, and he might get ten or twenty days for the other fellow's carelessness. The best way, then, is for every man to do honest work. Be honest with the other fellow. Be honest with your traveling engineer. Be honest with your Master Mechanic. Be honest with your shop foreman. You have been out on the road and have forgotten to drop a little oil in your link hanger, and the bushing got to cutting. It didn't get to cutting quite so badly that you had to stop or twist the pin off, or something of that kind, but sufficiently bad that you got down and worked over it a long time and you drove the pin out and you rubbed it off and you let it go. The best method would have been for you, when you got to the terminal, to go to your foreman and say, 'I have had a little trouble with that pin. I think, perhaps, it was due to my carelessness; I don't know; but I got along all right. I want you to look after it. It will need a little attention. You fix that up.' Will your foreman, will your Road Foreman of Engines, will your Master Mechanic take you to task for going to the foreman and talking in that way? If he does, I should like to see his photograph. When you are straightforward and you are honest in pointing out these things and have not covered them up, they have a great deal of respect for you, and many a man on a railroad has filled a more important position than he was filling because of that integrity, because of that honesty of purpose, because of the fact that he came out like a man and said, 'I did it. It was I, not he.' That is the best way, I think, in handling these things.

"I won't talk of compound locomotives, because we haven't any. Yes, we have one. But let me say something now. You are in convention assembled. What are you going to do here? Will it be a fact that when I come to read your proceedings next year, that I can take ten fingers and count on them the men who have discussed these papers in this convention, or shall I find that you beat the Master Mechanics' Association, and that the major portion of you—two-thirds or more—have been actively engaged in the discussion of these papers? When I was a boy, and a young man, and a man, if I wanted to learn something and wanted to commit something, get it right into me good and strong, I would talk about it. If I work up something to-day and I do not say anything about it or think anything more about it for a year, I shall forget it. If I talk about it, I shall know more about it. I shall have that imbedded in my memory in such a manner that I won't get rid of it.

"Now, if you take an interest in this matter, do not be afraid because you have not spoken before. Do not be afraid because you have not given the matter much thought. You do not have to be a theorist. You do not have to be a graduate of some technical school. What we need is practical ideas, and you men are, shall I say, choke full of them. I would rather a hundred times a man would come into my office and say, 'Mr. Quayle,' and go on to relate something to me in his practical way, full of rich, practical thought, as a result of his experiences on a locomotive, than to have a man come in to me and commence to talk to me of physics, and then commence to tell me something about the laws of mechanics and the laws of gravitation, and tell me about the chemistry of combustion. It is all right. It is magnificent, fellows, but after all the chemistry of combustion simply means burning coal, less smoke. That is the way to talk it, and never mind about these high-toned technical names. The man who has something to say, let him say it in his own manner. I want to say to you that if you will be your best self, be your natural self and talk in your own vernacular. You can't talk me, and you can't use my language, and you can't use my thought. You can't be me and I can't be you. You can say it a hundred times more impressively than can I, because, in the vernacular of the railroad man again, you are up against it every day, and you know just what to say—the right thing at the right time, and I would give more for your opinion on those things than I would for a hundred technical men's opinions on the practical things on the railroad. I want to tell you I am not putting a low estimate on technical matters, because I am plodding into that, and I am groping my way in the dark until I find my way out into the light. These technical men are valuable in their place and you in yours. As my little girl says, 'You in your small corner, and I in mine.'

"I hope, then, that you men will take hold of these topics this time, while you are in session here, in such a grand manner, in such a way that we shall be proud of you and you will be proud of yourselves. Don't you want to be proud of yourselves? I do. I am proud of myself. But, gentlemen, don't get vain. I am proud that I live in this age. I am proud that I am a railroad man in the year when railroads never were run so well as they are to-day. You ought to be proud to be members of this organization. Why? Because you have been selected to fill this position of trust. You did not vote for yourselves. It was not a question of a good fellow, a hail fellow well met, was it? No. You were selected for that position because the officers thought, at least, that you had the ability to fill it. What does that ability mean? First, it means this, that you men know considerable about a locomotive. When it gets out of order on the road, you go to the other fellow and tell him how to get it out—help him up. That shows that you must be something. You must have been thinking back in the years in the past. You must have been a student in your business. And then, again, you must possess the qualifications that are necessary to win the other fellow over to your side. I would not give one snap of my finger for the Traveling Engineer or Road Foreman of Engines that goes out on the road and antagonizes his fellow man. You have got no business in that position, if that is the kind of a man you are—no business whatever. The Master Mechanic, the Superintendent of Motive Power, the officer of a railroad that brings a man into his office and simply brings him there in order to antagonize him, in order to club him, in order to have him go out of that office feeling that that officer is not the gentleman that he ought to be, has no business filling that position. The officer on a railroad who is handling men must have the qualifications necessary to take hold of the man, no matter what his disposition may be or how small his

talents may be, to lift him up to a higher plane in every particular and to make him feel that you are his right hand support and that he can trust you—he can rely upon you, and that you will come to his rescue. Not that you will cover everything up for him. I don't mean that, gentlemen. I don't mean looseness; but that you will say to him, when you see him about something that is wrong, 'Charlie, now look here. I don't want you to be offended at me, but your record is not the very best on this railway, and you are doing so and so. You come into a station here and you drag in as though you didn't have any connection to make or as though you did not care when you got to the terminal. You are dragging in. You commence to apply your brakes away back there half a mile and then you release them and then apply them again. This train is never on time and you are at the bottom of it. Now come in properly, and if you have any time to lose, lose it coming out, where you are not consuming fuel.' Well, Charlie looks at you, and he says, 'Well, I didn't think about it before.' You then reply: 'Well, I know you didn't. Let me show you how I would do it. I don't think I am any better man than you generally, but we all have our faults, and this is yours.' And you get up there and you make your stop. I am not telling you how you do it. You know how you do it. You have various ways, and I don't care how you do it, so you get the result. Some men do things one way and some another; but the best way, of course, is the way. He looks at you and he says: 'That's all right, Mr. Road Foreman of Engines, I am much obliged to you.'

"The Road Foreman of Engines will say: 'If I could only get this man to pump his engine right; if I could only get him to.' 'Don't let any of the Traveling Engineers come into my office and tell me if they only could get them to do it. I believe that I can get that man to do it. I believe that I am capable of going out on this engine and getting the man to pump his engine rignt or do anything else right. If I can do it, why can't he do it? The Road Foreman of Engines will get on an engine and find all manner of fault with the engineman. That is wrong. When you are cross, don't go near the engineman. Keep away. Better stay at home than to go out on the road. You have no business there at all. But when you are all right, don't go to finding fault. Say: 'Charlie, how are you this morning?' He is feeling all right. 'That's good. Did you have a good breakfast this morning? How are things coming?'. He will say: 'He is a very nice fellow.' Don't say very much to him that morning. Jolly him along a little. Get the man to feel that you are interested in him; get the man interested in you, and you will get him interested in his work. If I have not my subordinates' interest in me personally, I am a failure. If I have not the major portion of the men on the Chicago and Northwestern Railway interested in me and willing to do anything reasonable for me, I will quit. I have no business there. Can't do anything with them, and there will be trouble.

"But if you want a man to rise to the highest standard of his manhood, to reach up to the full measure of success in that in which he is working, I want to tell you you must confide in him. You must trust him. You must appreciate him. You must feel that he is doing something that somebody else perhaps cannot do much better, and if you have got these fellows that are not doing as well as the others, coax them a little bit. How does the kindergarten teacher do in the school when two or three little children are not paying any attention to what is going on? The first thing you know, she throws up a little automatic bird and their attention is called right away. She brings that right into the play. She has got their attention. If a mother tells a child to do something and the child doesn't want to, and she insists, there is going to be trouble and the child gets a spanking. If she will simply divert that child's attention a minute and then ask the child to do it, why it will do it. We are only children of a larger growth.

The point is, you must learn the man and study his nature. He may be gruff on the exterior. He may seem to you as if he didn't have anything in him, but if you will reach down under the rough exterior, you will find a heart that is pulsating just as fast and just as warmly as is yours. I do not care how rough he is, away down under it all is the man, and you can educate him and you can cultivate him. You can make him your friend and then he will do your way. Am I right, gentlemen? Did you ever have a man get on your engine who, when he came on the footboard of the engine, would make you cross and unfit for your work that day? That man has no business there.

Let me say this in conclusion, that I am glad to be with you. Your association, your work, has my full endorsement. I would that I could help you in many ways to make your work a success, to make your burdens less arduous, and I believe that I voice the sentiments of the major portion of the officers of the various railroads of this country. We depend on you. We trust you. You are the men that make the engineers, the railways, the trains on time, a success. I have not the time to give the detail matters attention, and consequently you have to, and it is the details that make the bulk. You have the brain, and you have the brawn. You have the intelligence, and you have been selected for it. I trust that you may use the intelligence that you have in the direction of making the railroad company most prosperous; and when you do that you are working for John Jones, or for Mr. Wallace, or for Mr. Quayle, or for anybody who carries his own name with him. Now when I am achieving something for the Northwestern Railroad I am doing something for the railroad, but indirectly I am pushing myself to the front—without that thought in my mind. Don't have that thought in your mind, but earnestly work as do the Traveling Engineers of the Chicago and Northwestern, who are my right-hand men, who are holding up my arms, leading me to victory; and if you all do as well on your railroads as our men do on ours, you cannot help but be successful.

I thank you, gentlemen, and thank you, ladies.

(Applause.)

Palatial Dining Cars.

The C. B. & Q. has just turned out from the shops at Aurora a dining car that is about the finest thing of its kind ever placed in service. It is the first of a number of dining cars to be built and was constructed from designs prepared by the mechanical department. It is 66 feet over end sills, and the dining room has five large and five small tables, providing accommodations for 30 people. The design of the dining room follows the Italian renaissance style, the finish being in San Domingo mahogany with lemon brass trimmings. The deck is designed in full empire style with headlining decorations in gobelin green and gold. At each end of the dining room massive disengaged columns, reaching from the floor to the cornice, support the deck.

The window curtain boxes are placed about ten inches below the tops of the windows and the intervening space is filled with cathedral art glass, which adds a pleasing touch of color to the general effect. The car is lighted by electricity, the ceiling fixtures being combination electric light and gas, while each table has an electric candelabra. The various cupboards and closets for china, silverware and linen are equipped with roller curtains instead of doors, which is expected to add greatly to the convenience of serving.

We incline to the opinion that the cylindrical fire-box has received more attention in America than elsewhere, and that the best representative is the Vanderbilt corrugated fire-box, which is no longer an experiment. A valuable feature about the Vanderbilt system is that no change in the general design of the locomotive is necessary. Our British engineering journals ought to watch our acts of progress.

Locomotive Spectacular Play.

There is a play running in the Academy of Music, New York, in which the annexed picture is the sensation of one act. Locomotives have been introduced frequently, but they have been necessarily of such light material that their appearance was ridiculous. The engine shown in this picture is carrying rel.ei to a burning district and has the appearance of a modern Atlantic express engine, with the machinery working. The spectacular effect is produced by making the flaming woods move past the locomotive. It is wonderfully striking and well worth seeing.

Boiler Incrustation Is Useful.

"A place for everything and everything in its place" is a trite saying, and though, no doubt, there is a place for everything, it is sometimes not easy to get everything in its proper place. The Chicago & North-Western Railway people, however, have just made a very neat attempt to fulfil the latter part of the trite saying. They use what would otherwise become boiler scale, to coat the walls of roundhouse and shop, and the lime which inside a boiler would resist the passage of heat and diminish the efficiency of the machine is made to reflect the light of day and give a "sweet and clean" appearance to walls and posts. The water used in the boilers on the western part of the line is chemically treated by Davidson's method at West Side, Iowa, and a chalky precipitate is thrown down before the water finds its way to tank or crane. This solid matter has recently been used to whitewash the shop walls. The beauty of this arrangement is that the substance which can be used to advantage on the walls is never given an opportunity to incrust the boilers. Being opaque to heat, it is made to help distribute light in the buildings. Its absence in one place and its presence in another both serve useful purposes. The company notes a decrease in boiler scale and gives up the purchase of whitewash at one and the same time. The only trouble they experience at present is that they make more whitewash than they can dispose of, but the utilization of a by-product is one of the surest methods of effecting a permanent economy.

LOCOMOTIVE IN SPECTACULAR PLAY.

Systematic Handling of Scrap.

A very practical application of the old proverb, "Look after the pennies and the pounds will take care of themselves," is to be had by a visit to the Danville, Ill., shops of the Chicago & Eastern Illinois Railroad. Mr. T. A. Lawes, superintendent of motive power and machinery, has inaugurated a most thorough and comprehensive system for handling the locomotive and car scrap, which may perhaps be called a "by-product of railroading." Material is continually being reduced to scrap, and as it has a commercial value of some kind all the time, it is regularly and systematically handled at the C. & E. I. shops.

The road has about 140 engines and upward of 11,000 cars, and monthly shipments of scrap are made. In order to do this economically, scrap as it comes in to headquarters from outlying stations is sorted as it is taken from the car. A hetrogeneous mass of iron, steel, castings, rubber, etc., soon finds its various constituents in appropriate bins. The scrap bin as used has a length of 258 feet and a width of 40 feet. The floor is on a level with box car floors. The bins are 6 feet high by 30 feet long; the width varies from 24 feet to 6 feet, according to the quantity of scrap to be stored in them. The bins and supporting structure were made from old car sills at a cost of $700 for material and labor. The classification of scrap and capacity of bins are as follows:

	Tons.
1. No. 1 wrought iron	250
2. No. 1 cast iron	300
3. Tank sheets	30
4. Light sheets	30
5. Boiler steel	45
6. Elliptic springs	50
7. Coil springs	60
8. Flues	30
9 Flue clippings	30
10. Gas pipe	20
11. Journal boxes	60
12. Burned castings	60
13. Malleable castings	50
14. Channel bars	30
15. Soft steel	60
16. Iron and steel punchings	70
17. Staybolts and limed iron	70
18. Brass skimmings	45
19. Brass ashes	30
20. Cast steel	90
21. Sacks, rope and hose	20
22. Mixed turnings	30
23. Cast iron turnings	50
24. Wrought axle turnings	30
25. Steel turnings	50
26. Brass turnings and brass scrap	40

The scrap bins are in charge of a man thoroughly familiar with cars; in fact, he is a car repairer, and is therefore able to distinguish between what is strictly scrap and what is good second-hand material.

Mr. Lawes says: "It is truly a matter of astonishment what is found in scrap sent to the bins. New bolts, new washers, new castings, etc., are not infrequently sent to the bins with scrap material. Their presence there is due to the fact that car repairers order more material than is used on repairs of cars and this new material is gathered up with the scrap. It is sent back to the material bins for use. A large quantity of good second-hand material fit to be used again is removed from wrecked and from old cars. All good material of this nature is laid to one side and one man is engaged in wheeling this material to the casting pile or material bins, to be used again. The foreman of the blacksmith shop visits the scrap bins several times a day and advises the man in charge what forgings can be used again. By this double system of inspection all good serviceable material is saved, and the saving amounts to thousands of dollars in a year."

All damaged metal brake beams are looked over, defective parts removed and good parts applied. The making of good bolts out of defective ones is another part of the "industry" carried on at the scrap bins. Old bolts have been utilized to the extent of 6 1-2 tons a month, and this item of saving amounts to about $80 per month. Coupler knuckles are inspected, and all that are bent and not otherwise defective are col-

lected in lots of 100 and taken to the blacksmith shop and thrown into a furnace. They are then straightened in a former, made in two parts, under a blow of a steam hammer. The cost of straightening knuckles is 5 cents each. Brass skimmings formerly sold to the highest bidder are now dried and rattled in a flue rattler until the skimmings are clean. After being sifted the clean residue is melted and poured into castings, and a very substantial saving is regularly effected in this way.

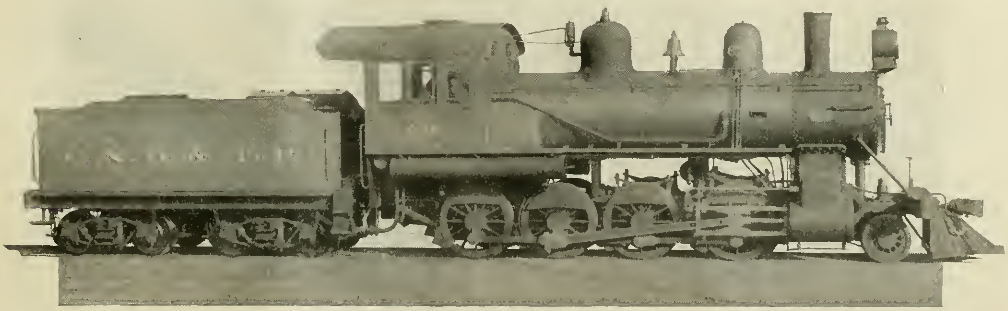
To sum up the lesson to be learned from the "scrap bin department," if so it may be called, and to do the work economically, the superintendent of motive power holds that scrap bin floors should be on a level with floors of box cars. The work of assorting scrap should be under the supervision of a man who has had experience in car repairs. Shears for cutting bolts, bolt-straightening machine and a bench with vise should be installed. The foreman of the blacksmith shop should make several visits each day to scrap bins, inspect the contents and have set aside such material as he knows can be used with advantage. Good judgment must be used in regard to the working over of scrap materials.

Consolidation for the C., N. O. and T. P.

The Schenectady works of the American Locomotive Company have recently turned out some comparatively light consolidation engines for the Cincinnati, New Orleans and Texas Pacific Railway. The engines are simple with 20 x 24-in. cylinders and 52-in. driving wheels, all flanged. The boiler is 54-in. diameter inside the first ring. The weight of these engines, which is 121,700 lbs., in working order, is determined by the capacity of the bridges now on the line. All renewals of bridges, are, however, being arranged for heavy power and rolling stock. The engine here illustrated has the modern wide firebox for bituminous coal, with sloping backhead, and altogether presents a plain though neat appearance. The working pressure is 180 lbs., and the main valves are the American balanced slide. The boiler is of the straight-top type, having ample steam room above the crown sheet and a 30-in. dome. The center line of boiler is about 70 in. above the rail. The two leading wheels are equalized with springs above the axles, the two rear wheels are equalized with a semi-elliptic spring between drivers and coil springs in front of the main driver and back of the trailer.

Some of these engines will be taken care of at the Chattanooga shops of the C., N. O. and T. P., where a new coal handling plant is being installed by the Chicago Link Belt Company. There are to be two coal pockets, each with 60-ton capacity, weighing hoppers. The ashes are, however, still shoveled by hand.

A few of the leading dimensions of these engines are appended:



C., N. O. & T. P. CONSOLIDATION.

GENERAL DIMENSIONS.

Gauge, 4 ft. 9 in. Fuel, bituminous coal.
Weight in working order, 121,700 lbs.
Weight on drivers, 105,000 lbs.
Wheel base, driving, 14 ft. 10 in.
Wheel base, total, 22 ft. 8 in.

CYLINDERS.

Cylinders, size, 20 x 24 in.
Dia. of piston rod, 3½ in.
Size of steam ports, 18 in. x 1¼ in.
Size of exhaust ports, 18 in. x 2¾ in.
Size of bridges, 18 in.

VALVES.

Greatest travel of slide valves, 5½ in.
Outside lap of slide valves, ⅞ in.
Inside lap of slide vales, 0 in.
Lead of valves in full gear, line and line.

WHEELS, ETC.

Dia. of driving wheels outside of tire, 52 in.
Driving box material, steeled cast iron.
Dia. and length of driving journals, 7⅝ in. x 8½ in.
Dia. and length of main crank pin journals, 5½ in. x 5¾ in.
Dia. and length of side rod crank pin journals, 6 in. x 5 in.

BOILER.

Inside dia. of first ring, 54 in.
Working pressure, 180 lbs.
Thickness of plates in barrel and outside of fire box, 17/32, 7/16, ½, ⅝ in.
Horizontal seams, butt joints, sextuple riveted, with welt strips inside and outside.
Circumferential seams, double riveted.
Fire box, length, 84 in. Fire box, width, 65 in.
Fire box, depth, F. 56½ in., B. 48½ in.
Fire box plates, thickness, side, 5/16 in.; back, ⅜ in.; crown, ⅜ in.; tube sheet, ½ in.
Fire box, crown staying, radical, 1⅛ in. dia.
Tubes, material, iron No. 12; W. 9.
Tubes, number of, 222. Tubes, dia. 2 in.
Tubes, length over tube sheets, 13 ft. 10 in.
Heating surface, tubes, 1,598.28 sq. ft.
Heating surface, fire box, 113.83 sq. ft.
Heating surface, total, 1,712,11 sq. ft.
Grate surface, 37 91 sq. ft.

TENDER.

Weight, empty, 36,100 lbs.
Journals, dia. and length, 4¼ in. dia. x 8 in.
Wheel base, 15 ft. 8 in.
Tender frame, 10 in. steel channels.
Tender trucks, 4 whl. channels, iron cen. bear.
Water capacity, 4,000 U. S. gallons.
Coal capacity, 7 tons.
Total wheel base of engine and tender, 48 ft. 3½ in.
Westinghouse automatic air brake on all drivers tender and for train; 9½ in. (L. H.) air pump, two main reservoirs, 1, 16 in. x 120 in ; 1, 18½ in x 114 in.;50,000 cubic in. capacity.

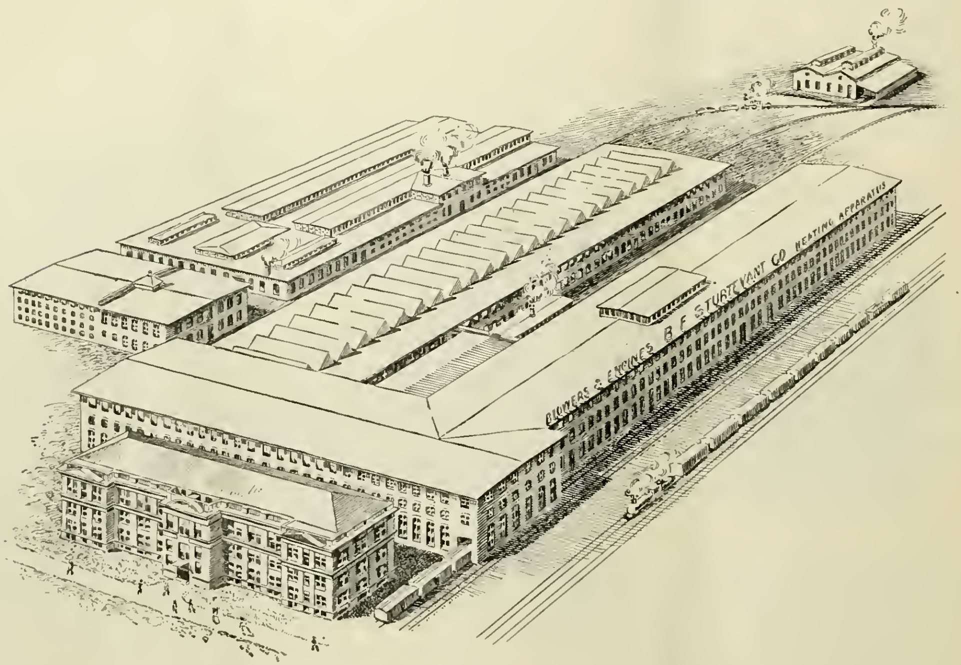
An Expert's Formula.

An inquisitive railroad man once asked a chemical test department expert, what was the real difference betwen ordinary alcohol, and wood alcohol, the former being sometimes taken as a beverage and the latter being poisonous. The expert replied that the formula for ordinary alcohol was "N. Y. P. & O.," while that for wood alcohol was "N. Y. P. & O. + Q.." He said, "I don't know what Q stands for, exactly, but that's where the trouble comes in with wood alcohol."

In rating engines, the formula for draw-bar pull, as shown by a dynamometer car is W., when put in operation for trains of varying length and gross weight of cars, it becomes W. + X, and X is the very important "make up" of train which involves a knowledge of how many axles the gross load is carried on. That is where the trouble comes in, on engine rating.

The New Works of the B. F. Sturtevant Co. at Hyde Park, Mass.

The new works of the B. F. Sturtevant Co., now nearing completion at Hyde Park, Mass., present an excellent opportunity to study the factors that control in the location and design of the modern manufacturing plant. The present plant at Jamaica Plain, Mass., is limited in its opportunity for growth, its capacity has long been strained to the utmost, and, as a consequence, the question of removal has continued to present itself with ever-increasing force. The fire which occurred last year forced an immediate solution, and a new site was selected after the most well-known as the home of such industries as the Becker-Brainard Milling Machine Co., the American Tool & Machine Co., the new shops of the N. Y., N. H. & H. R. R., etc. Here was presented a population of particularly skilled workmen which could readily be supplemented by present employees of the company, the new location being only 6 miles from the old plant. The lot selected has a frontage of about 1,300 ft. upon the freight yard of the N. Y., N. H. & H. R. R., etc., at Readville station, the distributing point for all freight passing over either the Midland or Providence divisions of said road. One side of the lot is bounded by the number of floors to be provided in the various buildings. The lay of the land and its available area being somewhat against a group of one-story buildings, and a simple calculation showing that the actual cost of the power expended in a sinble year for lifting the entire product of the works through a distance of 20 ft. figured only a little over a dollar, determined the company upon the building of multi-storied buildings. The character of the products of this company readily lent itself to such a design, and it was believed that the fixed charges on elevating machinery would be more than offset by a reduction in the horizontal distances



NEW PLANT OF THE B. F. STURTEVANT CO., HYDE PARK, MASS.

careful consideration. Aside from the general character of the lot itself the principal factors considered in reaching a decision were proximity to raw materials, and to an abundance of skilled labor, adequate shipping facilities, ample water supply, and space for ready disposal of waste material. The advantages of the West as against the East were carefully weighed, but the company readily expressed its abiding faith in the prosperity of New England, in the facilities which it presents for work of the character conducted by this company, and in the quality of its skilled labor as an offset to present somewhat higher rates for raw material. The best combination of advantages was presented by a lot of nearly 20 acres of land in the town of Hyde Park, Mass., already a plentiful stream known as Mother Brook, and the adjacent shore is at a level of nearly 10 feet below that of the yard and buildings, thus providing sufficient space for dumping waste material for years to come.

The site having been selected, most careful consideration was given to the size and character of the buildings; the head of each department was consulted, his recommendations reduced to writing, and frequent conferences held as to the requirements of the individual departments. With these data at hand the individual and aggregate areas were determined and the plans started with the idea of providing a total floor space slightly more than double that of the present plant. Consideration was first given to the question of necessary to be traversed by material.

The arrangement of the buildings was determined by the provision to be made for growth. One arrangement of a series of parallel buildings permitted increase only by multiplication of buildings, but provided an excellent opportunity for the carrying of switch tracks across both ends of each building. The other arrangement provided for a group of buildings parallel to the railroad tracks with accommodation for switch tracks between buildings, and for their entrance at the ends of the building, with an opportunity for growth by extension in length. After a careful working out of many schemes and a comparison of the advantages and disadvantages the latter arrangement was adopted.

The construction of the buildings next

received consideration. The latest development of all-steel and concrete construction with large window areas did not appear to meet the requirements of a group of buildings as permanent and substantial in their character as these. All-steel buildings with brick walls and concrete fire-proof floors presented disadvantages in the way of discomfort to workmen, inconvenience in attaching machines of hangers, and excessive expense, which did not appear to be offset by advantages to be secured in the way of absolutely fire-proof construction. The type finally selected is composite in its character, consisting of steel interior columns and main steel girders, with heavy brick walls, wood timbered floor and plank roofs. In the case of the one-story foundry, the roof is supported by steel trusses, in the other buildings open timbering with wooden columns in the upper floor is employed. The main floor in the machine shop is of tar concrete with spruce and maple flooring. The upper floors are carried upon wooden beams spanning the spaces between the steel girders, which follow a unit system of 20 ft. on centers through the building. All roofs are of 3-in. plank with tar and gravel top.

The question of power was early decided to the extent that the entire plant would be electrically driven from a central power house; that the engines would run condensing, that the exhaust steam derived from engines under test, which is considerable, would be utilized for heating with supplementary amount of live steam admitted at reduced pressure, as might be required. The final decision regarding the power house placed it sufficiently far from the ends of the buildings to permit sufficient extension of each, and near enough to the water supply to reduce to a minimum the expense of conveying condensing and other water.

The pattern building provides at one end a two-story portion 80 ft. square, for carpenters and flask makers on the first floor, and for pattern makers upon the second floor. The balance of the building, which is devoted to pattern storage, is provided with intermediate floors, making four in all, separated from the other portion of the building by double fire walls and automatic fire closing doors. The close proximity of this building to the foundry facilitates rapid intercourse.

The foundry, 170 x 350 ft. in dimension, is designed with the idea of distributing iron upon a track system, and is to be equipped with narrow gauge railways, bedded in concrete making runways between the moulding floors. Two crane-ways run lengthwise of the building through the greater part of its length, and the tracks extend beneath the crosswise traveling crane in the cleaning room at the end of the building. The brass foundry is located in one corner, a wash room in the adjacent corner, a core room between the two; the latter has ample opportunity for growth toward the center of the foundry, while the foundry itself can be extended to practically double its length. Storage for supplies is provided upon one side adjacent to the railroad switch. From the bins thus provided, the iron and fuel charges will be carried directly to the charging floor.

From the foundry the castings will pass to the rear of either the machine shop or the fan shop. The former is of the familiar gallery type, 500 ft. long, with wings 40 ft. wide, and central runway of the same width for crane of 20-ton capacity. The lighting will be principally by a series of sawtoothed skylights running crosswise of the roof with glass facing due north. The crane will serve the entire floor and transport heavy castings from the machine tools to the erecting floor, where the completed engine or generator may be lifted upon a transfer car passing through the testing building, and there picked up by another 20-ton crane, which will drop it upon the testing plate and subsequently carry it forward to the steam railway track, which passes through the end of the building and provides space for the loading of two cars at a time. The upper floor of this building, together with portions of the adjoining buildings, is devoted to the electrical department and provided with individual small traveling cranes.

The building devoted to the manufacture of fans, heaters, etc., is 80 ft. in width, of the same length as the machine shop, is three stories in height, of typical mill construction, provided with all conveniences for handling material and arranged so that shipment can be made from numerous points along one side, while supplies are brought in from the court between it and the machine shop.

The smith shop, 40 ft. by 80 ft., serves both buildings with equal facility, while the wash house and locker room, measuring 40 ft. by 100 ft., and three stories in height, is so located as to reduce to a minimum the distance to be traversed by the individual workman. The third floor will be used as a lunch room.

The standard first floor height in the main building is 17 ft., that of the second and third stories is 15 ft. The windows are large and numerous.

The office is to be a model structure of its kind, and is to serve as headquarters for the entire business. It will contain the correspondence, designing and drafting offices, the superintendent's quarters, and the cost department, the advertising bureau and a printing office, which will be located in the basement. It will be three stories in height with a finished attic to provide additional drafting room space.

The equipment of this plant will be largely "Sturtevant" in its character. Beginning with the power plant, the mechanical draft apparatus, the engines and generators and the exhaust head will be of Sturtevant make. The buildings will be heated by the Sturtevant system, the shafting and individual machines driven by motors of the same make, the refuse from the wood-working machinery, the dust from the cleaning room of the foundry, the ventilation of the offices, toilet rooms, and wash house, and the removal of smoke from the smith shop, will be accomplished by Sturtevant exhaust fans, while Sturtevant blowers will be used for brass and iron foundry, forge shop blast and the like, and Sturtevant steam traps will be employed upon the steam driers.

The accompanying bird's-eye view presents a clear idea of the general arrangement and appearance of these buildings.

Timely.

Dogberry says "comparisons are odorous," and perhaps they are, but contrasts are sometimes amusing, and if you wish for a very strong contrast, with a touch of humor in it, turn to the pages of Dickens and make a mental picture of the difference between the watch which Captain Cuttle gave, with much affection to "Wal'r," and that of a modern railroad engineer's or fireman's watch. The redoubtable captain in making his parting gift, with a great effort pulled out a silver watch, which was so big and so tight in his pocket that it came out like a bung. "Put it back half an hour every morning, and about another quarter toward the afternoon, and it's a watch that'll do you credit," he said. The Webb C. Ball Company's product does not need this kind of regulating. The watch has an improved safety double roller, seventeen and twenty-one ruby jewels, sapphire pallets, and moreover you can get the watch out of your pocket without effort. Mr. Frank N. Gear, of Cleveland, O., was at the Firemen's convention in Chattanooga, and explained the merits of the Ball's Official Brotherhood Standard Watches to the very practical railroad men who were in attendance.

The Effect of Slipped Eccentric.

I saw a question in one of your issues about an engine that would run ahead all right and when the engine went to move back with the right side on dead center, engine would not move, but would blow steam straight to the atmosphere. My answer is that the back motion eccentric slipped to where the forward motion eccentric was, and the valve with plenty of inside clearance and good lead with an ordinary train, would not move, but would blow down through steam past edge of valve to atmosphere.

F. E. Cochran.

Duquesne, Pa.

Of Personal Interest.

Mr. A. A. Read, Jr., has been appointed supervisor on the Lehigh Valley Railroad, with office at Delano, Pa.

Mr. T. J. Hurley has accepted a position as foreman in the Pittsburg Locomotive Works at Allegheny, Pa.

Mr. George Hay, of Oswego, has been appointed traveling engineer of the Rome, Watertown & Ogdensburg Railroad.

Mr. Frank Powers has been made assistant road foreman of engines, B. & O. Railroad, vice Mr. J. B. Dougherty, promoted.

Mr. R. P. Edson has been appointed train master of the Iowa & Minnesota division of the Chicago, Milwaukee & St. Paul Railway.

Mr. W. F. Kiesel, Jr., has been appointed assistant mechanical engineer of the Pennsylvania Railroad, succeeding Mr. A. W. Gibbs.

Mr. Alfred Lovel has been appointed assistant superintendent of motive power of the Atchison, Topeka & Santa Fe, with office at Topeka, Kan.

Mr. S. R. Richards, master mechanic of the Norfolk Division of the Southern Railway, has been transferred to the Mobile division, with headquarters at Selma, Ala.

Mr. J. F. DeVoy, formerly chief draftsman of the Chicago, Milwaukee & St. Paul Railway, has been promoted to be mechanical engineer on the same road.

Mr. A. R. Breckenridge has been appointed master mechanic of the Des Moines, Iowa Falls & Northern Railway, with headquarters at Iowa Falls, Iowa.

Mr. J. F. Sheehan, master mechanic of the Mobile division of Southern Railway, has been transferred to the Savannah division, vice Mr. C. F. Thomas, resigned.

Mr. A. Kennerdell, formerly general foreman at Cleveland, on the C., L. & W., has been promoted to the position of master mechanic, vice Mr. J. M. Graham, resigned.

Mr. J. A. Heether has been appointed superintendent of the Charleston division of the Southern Railway, with office at Charleston, S. C., vice Mr. F. K. Huger, resigned.

Mr. J. B. Dougherty has been promoted from assistant road foreman of engines on the Baltimore & Ohio, to the position of road foreman of engines, vice Mr. L. B. Hart, resigned.

Mr. David Bell has been appointed superintendent of the Canadian Pacific, at Moose Jaw, N. W. T., vice Mr. C. W. Milestone, resigned. Mr. W. A. Brown has been made division superintendent at Broadview, N. W. T., Canada.

Mr. H. E. Smith has resigned as chemist of the Chicago, Milwaukee & St. Paul to accept a similar position on the Lake Shore & Michigan Southern, with headquarters at Collinwood, Ohio.

Mr. Emmett A. Gould has resigned as superintendent of the eastern division of the Wabash Railroad, and will succeed Mr. Daniel Hardy as general superintendent of the Missouri Pacific Railroad.

Mr. J. J. Baylie, general foreman of the Southern Railway shops, at Manchester, Va., has been promoted to be master mechanic of the Norfolk division, with headquarters at Lawrenceville, Va.

Mr. J. J. Scully, formerly assistant to the master mechanic, Canadian Pacific Railway, Winnipeg, Man., has been transferred to the operating department of that road, as chief clerk for the general superintendent, western division.

Mr. B. D. Lockwood has been appointed mechanical engineer of the Wisconsin Central, with headquarters at Milwaukee. He has been for a number of years chief draftsman of the motive power department of the Big Four road.

The board of directors of the Baltimore & Ohio Railroad have appointed Mr. George F. May, assistant secretary of the company, with office at Baltimore, Md., vice Mr. W. H. Williams, appointed assistant to the general manager.

Mr. A. W. Gibbs, assistant mechanical engineer of the Pennsylvania Railroad, will succeed Mr. A. Kearney as superintendent of motive power of the Philadelphia, Wilmington & Baltimore, with headquarters at the Broad street station, Philadelphia.

Mr. John McGie, master mechanic of the Central Railroad of New Jersey, has resigned, to accept the position of general master mechanic of the Choctaw, Oklahoma & Gulf Railroad. He was formerly general master mechanic on the Montana Central.

Mr. H. T. Bentley has been given the position of assistant superintendent of motive power and machinery of the Chicago & Northwestern. He was formerly master mechanic of the C. & N. W. Ry. at Clinton, Iowa. His headquarters will now be in Chicago.

The following appointments have been made on the Yazoo & Mississippi Valley Railroad: Mr. J. F. Wallace, to be general manager, and Mr. W. J. Harahan to be assistant general manager, both with offices at Chicago. Also, Mr. H. U. Wallace to be chief engineer of the road.

Mr. Alexander Kearney has resigned as superintendent of motive power of the Philadelphia, Wilmington & Baltimore to accept the position of superintendent of motive power of the lines of the Baltimore & Ohio, west of the Ohio River. He will have his headquarters in Pittsburg.

Mr. D. O. Smith, for many years master mechanic of the Manchester & Oneida Railway, and until recently master mechanic of the Mobile, Jackson & Kansas City Railroad, at Mobile, Ohio, has resigned from the latter road to accept a position with the C. W. Zimmerman Lumber Company, of Jackson, Ala.

Mr. J. E. Mulfield has been appointed assistant to the general superintendent of motive power of the Baltimore & Ohio Railroad, with headquarters at Baltimore, Md. He will have charge of the mileage and maintenance of locomotives, improvements and designs of coaling stations and shops, and improvements in the tools and machinery.

The following new appointments and changes are reported on the St. Louis & San Francisco Railroad: Mr. A. Lister has been made road foreman of engines on the western division. Mr. Chas. Mills has been promoted to the position of train master of the Oklahoma & Red River division. Mr. Joseph Elliot has been appointed superintendent of terminals at St. Louis. Mr. H. H. Brown, formerly train master on the western division, has been transferred to a similar position on the eastern division. Mr. W. W. Campbell has been promoted to acting train master of the western division.

The following changes are reported on the Illinois Central Railroad: Mr. W. J. Harahan has been appointed assistant general manager, with office at Chicago. The chief engineer, chief engineer of construction, consulting engineer and superintendent of machinery will report to him. Mr. A. Philbrick has been appointed superintendent of the Louisville division, with office at Louisville, Ky., vice Mr. J. C. Dailey, transferred. Mr. J. G. Neudorfer has been appointed superintendent of the Mississippi division, with office at Water Valley, Miss., vice Mr. A. Philbrick, transferred. Mr. H. U. Wallace has been appointed chief engineer, and Mr. J. C. Dailey has been appointed superintendent of the Freeport division, with office at Freeport Ill., vice Mr. H. U. Wallace, promoted.

Mr. E. T. Needham has been appointed acting master mechanic at Fort Wayne, on the Wabash Railroad. He fills the place vacated by Mr. M. R. Coutant, who has gone to the Erie.

Mr. F. M. Mast has been appointed superintendent of motor power and car equipment of the Lake Erie, Alliance & Wheeling Railroad, with headquarters at Alliance, O., in place of Mr. F. Gleich, who has been assigned to other duties.

Mr. W. O. Thompson, so well known as Secretary of the Traveling Engineers' Association, has been promoted from the position of traveling engineer of the New York Central to that of Assistant Superintendent of Motive Power of the Rome, Watertown & Ogdensburg divisions, with headquarters at Oswego, N. Y.

Mr. S. E. Cotter, formerly fuel agent on the Wabash Railroad, has been appointed superintendent of the Eastern division of that road, with headquarters at Peru, Ind., in place of Mr. E. A. Gould, resigned. Mr. Robert J. Woods, heretofore private secretary to the president, has been appointed fuel agent, with headquarters at St. Louis, Mo., succeeding Mr. Cotter.

Mr. P. T. Lonergon, master mechanic of the New York Central at Oswego, N. Y., has resigned to accept a similar position on the Rutland Railroad. Mr. Lonergon was for years chief draftsman of the mechanical department of the New York Central, and took an active part in the development of the big passenger engines so successfully carried out by Mr. William Buchanan.

Mr. Archie J. McKillop was recently appointed master mechanic of the Illinois Central at Mattoon, Ill. He entered the service of the Michigan Central (Canada Southern division) in 1887, as locomotive fireman, and was subsequently promoted to the right side. In 1892, he went to the Illinois Central in a similar capacity. He was appointed traveling engineer of the southern lines of that road in 1901, which position he held until his present appointment came about.

Mr. M. R. Coutant has been appointed master mechanic of the Erie Railroad at Susquehanna, vice Mr. Fuller, promoted. Mr. Coutant was for several years mechanical engineer for the Wabash Railroad at Springfield, Ill., and subsequently assistant master mechanic at Fort Wayne, Ind.

Mr. George D. Brooke, master mechanic of the Iowa Central, has been appointed superintendent of motive power of the combined Minneapolis & St. Louis and the Iowa Central lines. Mr. Brooke has enjoyed a highly varied railroad experience, which renders him a peculiarly efficient official for the mechanical department. We have known him as mechanical engineer for the Wabash, master car builder on the B. C. R. & N., master mechanic of the St. Paul & Duluth, and then master mechanic of the Iowa Central. He has always been highly popular and thoroughly efficient.

The following changes are announced on the Erie Railroad: Mr. C. E. Fuller, heretofore master mechanic at Susquehanna, Pa., has been appointed assistant mechanical superintendent for lines east of Salamanca, with headquarters at Meadville, Pa.; Mr. W. N. Perrine has been appointed master mechanic at Rochester, N. Y., to succeed Mr. I. Bond, resigned; Mr. W. S. Haines, heretofore superintendent of motive power of the western lines of the Baltimore & Ohio, has been appointed master mechanic of the New York division and branches, including the Port Jervis shops of the Erie Railroad, with headquarters at Jersey City, N. J., to succeed Mr. H. A. Childs, assigned to other duties.

The Executive Committee of the New York Railroad Club have decided to change the meeting night from Thursday to Friday at 8 P. M. The meetings in future will be held at Carnegie Hall, 154 West Fifty-seventh street, New York City.

"The World's Railway" is the name of the most beautifully illustrated engineering book ever published. The selling price was originally ten dollars, but we are now giving the book and a year's subscription to Railway and Locomotive Engineering for five dollars. If you wish to secure this bargain write soon.

Christmas Presents.

These will soon be the subject of consideration. Let us give you a suggestion. A good book is always suitable and welcome. For people with mechanical leanings the page of books in our advertising pages provides an excellent choice. If you wish to combine fun with knowledge, get "Jim Skeevers" and "Stories of the Railroad," both by John A. Hill. Together they cost only $2.00.

The Chesapeake & Ohio people have ordered a Shay locomotive, which will weigh about 150 tons. The engine, of course, is intended for mountain service and will be the heaviest geared locomotive ever built.

The Wheeling & Lake Erie employees at Norwalk, O., numbering some 200 or more, have been notified that their pay has been increased 2 1-2 cents an hour. The increase affects both shop men and foremen alike.

Electrical Apparatus in English Coal Mines.

The coal mines of England, the primary source and the essential element of her industrial supremacy, have now been worked extensively for more than a century. Until a few years ago England mined more coal than any other country in the world. However, this is no longer the case. It has been estimated that 500 years will see the end of England's coal supply and long before that the mining of coal must become so difficult and costly, and the price of coal so high, that English manufacturers will be seriously handicapped, or compelled to seek other locations where cheap fuel is to be found. The price of coal in England is steadily rising, shafts are being carried deeper and deeper, and, the richer veins having been exhausted, the thinner veins, containing often poorer grades of coal, must now be developed. These things have put the British operator upon his mettle, and he has taken up the latest and most improved methods of coal mining, even more rapidly than his American competitor. Moreover, he has stepped out boldly and adopted for power transmission, alternating currents and induction motors, which, for mining work and especially coal mining, have many great advantages over direct-current machinery.

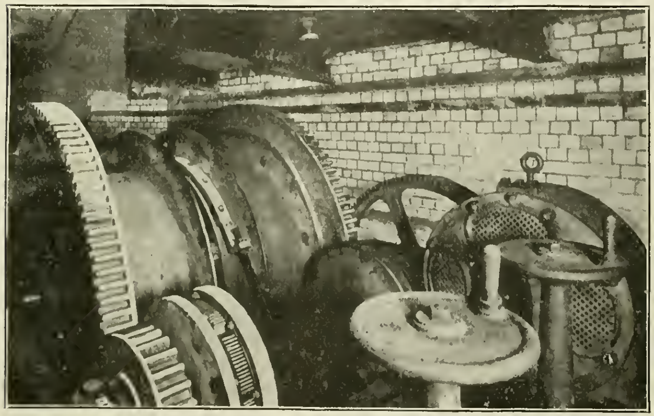
The Sneyd Colliery, at Burlem, Staffordshire, has recently put in a complete alternating current equipment. Current is generated by a Westinghouse three-phase alternator, direct coupled to a Westinghouse steam engine. These mines are gaseous, and the use, in them, of direct current machinery would have been dangerous. The induction motor, however, on account of the fact that it has no moving contracts to spark or flash, is well adapted for use in such locations.

The Clapwell Colliery and the Oxcroft Colliery, both situated at Chesterfield, have each recently installed two three-phase Westinghouse alternators. The British Westinghouse Company furnished ten induction motors, aggregating 280 h. p. to the Clapwell mine, and 13 induction motors with an aggregate capacity of 300 h. p., and a complete switchboard outfit to the Oxcroft Colliery.

About 4,000 h. p. of Westinghouse electrical apparatus is about to be installed in the several collieries owned by the Stavely Coal & Iron Company, of Chesterfield. The Sherwood Colliery, of Mansfield, have purchased two three-phase Westinghouse alternators; also three direct current, multipolar generators of about 12 K. W., aggregate capacity. At the Tredegar Iron & Coal Co.'s Collieries in Monmouth a complete electrical power equipment is being installed. The Bolsover Colliery Co., of Chesterfield, has decided to adopt electric driving to a considerable extent, and has placed a large order with the British Westinghouse Co., including a 180 K. W., three-phase alternator.

The Stanton Iron Works Co., of Pleasley, will soon equip their collieries with electrical apparatus. The Tyrdail Collieries, of Carmarthen, have contracted for an electric power installation, consisting of a 60 K. W., three-phase, Westinghouse alternator, exciter, switchboard, and about 50 h. p. of induction motors. The New Cross Hands Colliery, of Lanelly, has purchased an electrical power equipment, with switchboards, etc., complete, and several Westinghouse direct-current motors.

From these examples it will be ap-



WESTINGHOUSE ELECTRIC MINING MACHINERY IN ENGLAND

parent that the British manufacturers are by no means slow to see the economies of electric driving, and when their mines have been thoroughly equipped, they may yet, for a long time to come, give the Americans a very stiff fight for European markets.

Tanite is a hard, black, fine-grained material made out of waste leather. This is used in connection with emery to make abrasive wheels. This origin of tanite has no doubt suggested to the Tanite Co., of Stroudsburg, Pa., the propriety of using the latin motto, *Ex inutili utilitas*—"useful from waste"—as part of their trade-mark. In a circular recently issued the company state that a tanite-emery wheel, 13 1-2 inches diameter, 2 inches thick, ran for 30 minutes at the rate of 1,630 revolutions per minute. In this half-hour it ground off 13 pounds 2 1-2 ounces of cast iron. During the same time an expert workman, filing steadily, removed 6 3-4 ounces of cast iron. The circular, which gives information regarding these wheels, will be sent by the Tanite Co. to anyone applying for it.

The Cleveland Machine Screw Co., of Cleveland, O., changed their name on the first of October last to the Cleveland Automatic Machine Co. The change was made to better harmonize the name with the character of the product turned out. By this change they hope to eliminate from their mail inquiries for screw products. The company's shops have been enlarged and the output is now confined to high-grade automatic machinery.

The National Malleable Castings Co., of Cleveland, O., have recently put upon the market a patented car door lock, which is called the "National Safety" car door fastener. It is designed to prevent the door being opened without the seal being destroyed. The hasp is secured to the car door by a staple, which has one leg let into the door, and the other is bolted up with a round-headed bolt, the nut on which is inside. This prevents the staple from being pried off. The hasp passes over a malleable staple with seal pin, which are also secured with round-headed bolts. The pin slides up and down in a slot, which is covered by a rivet head so the pin cannot be lost. As the seal wire passes through a small hole in the bottom of the pin and also through the opening in the hasp, the door cannot be opened unless the seal wire has been destroyed. To prevent the door being pulled back, even the length of the slack of the wire, the bolt or pin fits so snugly in the staple on the door post, that it cannot be pulled up without cutting the seal wire. This prevents the door being opened at all, without giving evidence of the operation.

The Book of the Royal Blue, for October, issued monthly by the Baltimore & Ohio Railroad, has come to hand, and contains an interesting article on the marvelous Advance in Telegraphy which have been made in the last 58 years, since Morse sent the first telegraph message from Baltimore to Washington over the wires of the B. & O. The article is principally concerned with the Rowland System, which transmits four messages in each direction over one wire at the same time. Mr. C. M. Staley contributes an article on West Point. Autumn Days at Atlantic City comes from the pen of Dr. Thos. Calvert. A sketch of Louis Kossuth is illustrated by a half-tone of the statue of the patriot, to be erected at Cleveland, O. The city of Washington, ninety-eight years ago, is an extract from the diary of Chas. Wilson Peale, the famous portrait painter of revolutionary times. Some witty Stub Ends of Thought, by Arthur Lewis, close the month's issue.

"Packing Sense" is a little pamphlet got out by the United States Metallic Packing Co., of 427 N. Thirteenth street, Philadelphia, which contains some brief remarks intended to be of value to those who use this company's packing. The importance of lubrication is insisted upon as one of the ways in which to give the packing fair play. "Packing Sense" says: "Don't apply new rings for all packing troubles. Investigation may show that something else is wrong." The author of the pamphlet also humorously adds: "Don't use new metal for soft hammers and in counter-balancing wheels, and put scrap material in packing rings, reverse the operation." The booklet will be sent to anyone who is interested enough to apply to the company for it.

The Chicago Pneumatic Tool Company report that their air compressor plant, at Franklin, Pa., is operating day and night. Among recent sales made by this company are two large compound compressors for the New York Central & Hudson River Railroad Company's Jersey Shore Shops; two large compressors for the Readville Shops of the New York, New Haven & Hartford Railroad; a compound compressor of 2,000 cu. ft. capacity per minute for the Lake Shore & Michigan Southern's Collinwood Shops, being a duplicate of the first compressor installed; a 1,000 ft. compound compressor for the St. Louis, Iron Mountain & Southern Railroad, and one of the same capacity for the new shops of the C., C., C. & St. L.

Per Diem Produces Results.

Mr. J. M. Daly, superintendent of transportation of the Illinois Central Railroad, writing of the per diem system, says the Illinois Central is 5,000 cars better off wherewith to handle traffic now than twelve months ago. In the past year 3,000 new cars have been built for the road, and 2,000 cars have been brought home by per diem. In previous years connecting roads with a small number of freight cars would get hold of cars of the larger systems in the summer months and would sidetrack them until September and October, when they would be needed. As long as the cars were idle they cost no rent. Now the tables have been turned. Foreign roads hurry cars back to the home lines, instead of sidetracking them to await the busy season.

The Philadelphia Pneumatic Tool Co. reports that in the month of August they broke all previous records in the amount of goods shipped. Recent large orders have been received by them from the Cambria Steel Co., Pennsylvania Steel Co., New York Shipbuilding Co., Newport News Shipbuilding & Dry Dock Co., and Grand Trunk Railway Co. Foreign orders have been received from Paris, London and Copenhagen. More orders have come in for rotary drills during the past two months than ever before. This company have just added to their machine shop equipment eight engine lathes, two automatic machines, two turret lathes, two grinding machines, one Fellows gear shaper, six drill presses, one universal milling machine, one twist drill grinder and a number of other minor machine tools.

Mr. Geo. H. Daniels, general passenger agent of the New York Central Railroad, has issued an illustrated catalogue of the "Four-track Series" of folders. There have been thirty-five issued so far in the series, and each page of the catalogue contains a fac-simile of the cover of each folder, with appropriate letter press, and generally a typical reduced half-tone from the interior of the folder. If you are ignorant of the series, the catalogue gives you the whole thing in outline. If you are short of some particular number, consult the catalogue. If you have forgotten, or given away a folder you would like now to have, look it up in the catalogue and write Mr. Daniels, Grand Central Station, New York.

The Kennicott Water Softener Co., of Chicago, are putting several of their plants on the Santa Fe system. One at Dodge City will have a capacity of 8,000 gallons an hour. There are to be three others. One at Syracuse, Kan., whose output will be 4,000 gallons hourly; at Lamar, Col., 4,000; and at La Junta, Col., 2,500 gallons. It is probable that this is a move which will not end until all along the Santa Fe lines places for treating the water used in the engine boilers are built. The cost is great, but the expense of keeping flues and boiler parts in repair is one of the largest which the western railroads have to pay.

Ground has been broken in South Venice by the Chicago and Alton Railway for a new roundhouse and repair shops. The new building, which will be equipped with the most modern improvements, will be situated west of the present roundhouse. The new shops adjoining will do all engine repairs on the road south of Bloomington.

For the first six days of September there were received at the New York Central's Station, New York, 34,259 pieces of baggage, an average of 5,700 pieces per day. During the second week of September the average was a little over 3,000 pieces per day. The baggage came in so rapidly and there was so much of it that the platforms were with difficulty kept clear for incoming trains.

The Brotherhood of Locomotive Firemen has created two new classes of insurance, making five classes in all, and in amounts, $500, $1,000, $1,500, $2,000 and $3,000. Under the old rule the limit of insurance was $1,500. The change is made with a view of accommodating policy holders who are promoted to engineers with increased salaries and who desire an increase of insurance. The Brotherhood is quite strong in Louisville.

It is reported that the Pennsylvania Railroad are preparing estimates for the new freight cars they will have constructed in 1903. It is believed the company will have in the neighborhood of 12,000 new cars. The number constructed this year was upward of 20,000. The new cars will be of 100,000 pounds capacity at a cost of over $1,000 each.

The Crane Company, of Chicago, have just issued their 1902 pocket catalogue, which embraces their full line of valves, fittings, steam specialties, engineers' supplies, etc. The book contains 464 pages and is well illustrated and comprehensively indexed. The company will be pleased to mail the catalogue to those who are interested enough to apply, who will mention RAILWAY AND LOCOMOTIVE ENGINEERING when writing.

Not Worrying About Coal.

A startling announcement was once made in a country newspaper to the effect that a local genius had discovered how to cut wood without using an ax or a saw—he did it with a hatchet. A somewhat similar announcement is contained in a recent press dispatch from the far West, which says that the Southern Pacific will soon entirely abandon the use of coal! They will, however, boil water in their locomotives by burning oil as fuel. The dispatch says:

"Oil has proved such a success on the lines of the Southern Pacific that general orders have been issued for the conversion of all the engines into oil burners as soon as possible, and within a year the Southern Pacific will be on an oil basis. The division, generally known as the western, is in the lead in the number of oil-burning engines. It now has 63 oil-burning engines. There remain 83 yet to be converted. It requires on an average 1,000 gallons or about 24 barrels of oil for every 100 miles as compared to five tons of coal. The saving on every 100 miles by using oil-burning engines represents from $36,000 to $40,000 a month. The company has expended upward of $5,000,000 for oil. On the western division alone the saving a month, when all the engines have been converted, will approximate $75,000. When the other Coast divisions use oil exclusively, the total sum saved will be upward of $100,000 a month.

"The opinion of those best informed is that it will take ten months and possibly a year for all the locomotives on the Pacific Coast to abandon coal. All the engines which go into the repair shops at Sacramento, Los Angeles or Oakland come out as oil burners."

Contracts were let last month by the Pittsburg & Lake Erie for the rolling stock, new equipment, and steel rails for 1903. The amount of money involved is $2,250,000. The items of contract are 1,000 steel cars to the Standard Steel Car Company, of Butler; thirty consolidation freight engines to the Pittsburg Locomotive Works; five Atlantic type passenger locomotives to the same company; ten passenger coaches to the American Car and Foundry Company; fifteen thousand tons of steel rails to the Carnegie Steel Company. Other contracts for miscellaneous material will aggregate another million.

There is considerable agitation going on in the Eastern States to the manufacture of various kinds of artificial fuel. The attention of a group of retail coal dealers and capitalists has been turned toward the establishment of a plant in this country for the manufacture of briquette, a fuel made in Germany both from peat and from the slack or waste of soft coal mines. For ten years or more the manufacture of briquette fuel has been an important industry in Europe. There are at least ten plants in Germany, which turn out upward of one hundred thousand tons of briquette annually. Briquette is in reality artificial coal. In Germany lignite, or carbonized peat, is found in large quantities.

Wasn't Looking for That Run.

Superintendent of the Railroad Company—So you want a job as fireman, eh?

Applicant—Yes, sir.

Superintendent—I'll have to ask you a few questions. How far is it to the north pole?

Applicant—Gee whiz! If you're going to put me on that line I don't want the job.—*Indianapolis News*.

A middle-aged man went to Wall Street, New York, one day lately and shouted: "As an American citizen and a native and resident of Connecticut, I came here to protest against the great speculative plot to buy and sell my native State. Inflated financial interests, centered there, have tried to buy the legislative, executive and judicial machinery of that State in order to promote schemes of speculation. I wish to protest earnestly and publicly against this great conspiracy, which must be overthrown. May the example of Washington inspire us to truth and patriotism in all our business affairs."

This Connecticut native is behind on his knowledge. The New York, New Haven & Hartford Railroad have already got possession of the institutions he fears speculators may buy.

The Kennicott Water Softener Company announce that owing to the demand for their water softeners by railroad companies, they have withdrawn the agency from the J. S. Toppan Co. and inaugurated a railroad department, which is under the personal supervision of Mr. Wm. R. Toppan, 77 Jackson Boulevard, Chicago. The manager of the newly formed department states that there are sixteen Kennicott water softeners now under construction for railroads. Capacity from 4,000 to 20,000 gallons per hour.

French steel rail makers evidently secure good prices for home work. In a recent contract for 31,875 metric tons, to be delivered in three years at Thouars, bids ranged from 169.85 francs per metric ton to 173.15 francs. At 19.3 cents per franc 170 francs per metric ton is equivalent to $38.34 per gross ton.

Investigating Our Railroad Operating.

Mr. H. A. Watson, general superintendent of the North Eastern Railway of England, is in the United States for the purpose of making observations regarding our railroads and their methods of operation. He has several other officials with him, who will take notes in regard to the matters most interesting to their own departments. It will be remembered that last year Mr. Gibb, general manager of the same railway, spent several months in this country investigating our railroad system and that he was accompanied by several of the leading officials. The visit of Mr. Watson is intended to supplement the information obtained by Mr. Gibb.

The railroads of the United States continue to be the makers of railroad investigators from all over the world. There have been parties here all summer that have come as far as India and Australia to take notice of how our railroad operations are carried on. Among the late visitors is Herr Paul Schuler, an engineering architect in the employ of the German Government, who is in the United States on a special mission to study locomotives, having been sent by the Government. Mr. Schuler expects to visit all the locomotive building plants in the United States for the purpose of studying the workings of them.

Records of Wheel Failures.

The secretary of the M. C. B. Association has issued the following circular: "The committee on cast iron wheels requests me to announce that it expects, within the next two or three months, to send out a circular of inquiry concerning wheel failures and breakages, and would respectfully ask that each member maintain as complete a record as possible of all wheel failures and their causes that have occurred on their road, as they will be requested to give as complete a record as possible of these failures to help the committee in making its annual report to the convention next June."

To Deliver Orders to Trains in Motion.

Mr. Amos M. McKenna, an old Santa Fe engineer, at Emporia, Kan., has invented apparatus for delivering orders to trains in motion which has been adopted by the company he works for.

The invention consists of a large wire loop fastened to the end of a stout stick. Attached to the loop is a metallic case containing a written copy of the orders for the locomotive engineer or conductor. On the stick is a signal lamp and a reflector, to give notice to the engineer of the oncoming train that orders are awaiting him.

The station agent holds up the loop within reach of the engineer, who grasps it as he flies past. The wire loop with the orders attached automatically detaches itself from the stick and the signal lamp.

This invention will obviate the necessity of stopping heavy trains at small stations for orders. Instead, the orders are telegraphed ahead of the train to the station agent, who immediately arranges his signalling device and awaits the train. Without slackening speed the engineer gets the orders.

A Novel Refrigerator Car.

Schwarzschild & Sulzberger, of Kansas City, have inaugurated a new form of refrigerator car which they expect to make a combination of business and freight-carrying car. They found it was too expensive to keep an office in every town where they do business, so they conceived an idea of making refrigerator cars with an office annex. One car was tried for the purpose, and it was found so satisfactory that they have ordered twelve more to be built forthwith.

The original car was 54 feet long, but the new one measures 65 feet over sills and is 9 feet wide outside. The interior is divided into two rooms, the cooler and the office. The refrigerating room is 54 feet long and is provided with two end and four intermediate ice boxes having a total ice capacity of 9,000 pounds. Three overhead rails run the length of this room for the suspension and handling of meat. The cubical capacity of the cooler is 3,024 feet. The office is equipped with cashier's desk and a Fairbanks Standard scales. Behind the gate the office is 4 feet 6 inches deep and between the gate and desk to the door of the cooler is a space of 5 feet, at the sides of which are placed the main car doors. The car is thoroughly equipped with incandescent lights, the current for which is furnished by storage batteries placed in the storeroom, or "possum belly," beneath the car center, which is 2 by 7 by 16 feet and contains space for carrying tools and miscellaneous articles.

This car was designed by Mr. F. W. Wilder, general manager of the Schwarzschild & Sulzberger Company.

For years after the Hoosac Tunnel was first made, the country people used to come for miles around to watch the trains plunge into the dark hole in the mountain side. One day a green Irishman was conveyed by a friend to see the striking sight. He watched with eager eyes the train rushing along and on seeing it plunge into the black tunnel, gasped with relief and exclaimed:

"By Jasus, it would be hell if she happened to miss the hole."

New Locomotive Works.

The Standard Motive Power Co. are shortly to begin the erection of their plant at Canal Dover, O. This city has given them 58 acres of land and a cash bonus of $10,000. The company for this consideration agree to employ 1,400 men when the plant is in full operation.

The officers are: Mr. Milton Blake, president; Mr. A. P. Dodge, 60 Broadway, general manager; Mr. W. H. Hoar, secretary and treasurer, and Mr. Fowler, chief engineer. Mr. McNutt is the banker back of the concern, and all of the above gentlemen are located in New York City. They favor the B. & O., and there is a dispute about right of way with the Pennsylvania, which is retarding the work. The Pennsylvania is laying track and switches to the grounds, and some of the grading for the buildings has already begun. Mr. A. P. Dodge is the leading spirit in the concern, and it's the Dodge engines that are to be built, principally. What their particular feature is, nobody could tell me, and Mr. Dodge was in New York. The above information is from the Canal Dover Land Co., who engineered the deal.

J. A. Baker.

Sparks Collecting on Netting.

I fired an engine once that gave somewhat the same trouble as the one described on page 436, October Railway and Locomotive Engineering. I noticed on starting out that her netting seemed to be stopped up, and after going, say 50 or 60 miles, it seemed to get clean. She had a front end with most of the netting set horizontally.

One day when it was opened I found about eight inches of cinders lying on the straight netting, and perhaps ten inches of the sloping netting was clean.

The only way I could explain it was that the opposite fireman, being a green hand, used the rake too much in starting out; in fact. I know he was spoken of as "having the hook in her all the time," while I hardly ever used it, and by using the blower pretty freely, "hitting" her pretty hard starting out, and leaving the door on the latch, would generally clean her after awhile.

W. C.

Buffalo, N. Y.

Schenectady Locomotives for Export.

Fifteen locomotives of an order for thirty received from the Imperial Government Railroad of Japan have just been completed at the Schenectady works of the American Locomotive Company.

One locomotive for the Cape Government Railroad, South Africa, has also been completed and will be shipped soon.

The South African locomotive is small, but those for the Japanese Government are still smaller. They are remarkably fine engines, and are not only well constructed and powerful, but are handsome in appearance, all the trimmings being of polished brass. They have copper-lined fire-boxes and brass flues.

The engines are all taken apart and boxed, ready for shipment. A good-sized freight train will be required to carry the locomotives to the seaboard, where they will be shipped to Japan.

The Buffalo Forge Company, Buffalo, N. Y., have issued a neat little booklet of 52 pages, describing the typical features and the operation of their Downdraft forges, stationary forges. Tuyere irons, volume blowers and exhausters, steel pressure blowers, steel plate exhaust fans, improved countershafts, blast gates, portable forges, etc., etc. Anyone interested enough to apply for the booklet will receive one from the company.

Electric Time-Keeping.

The Canadian Pacific Railway has put in operation a novel method of looking after the "time" of shop employees at Montreal and at Toronto Junction. At the latter station the timekeeper's office is in a building apart from the shop, and the timekeeper, sitting in front of a standard-time clock, operates two electric switches and does not see or speak to the men whose arrival he is subsequently to record.

At convenient places in the shop, cabinets containing brass checks, about the size of a quarter-dollar piece stamped with a number, are hung each on a little hook. The men retain possession of the brass checks when they are not working, and deposit them in the lower or horizontal portion of the cabinet when they come to work. The cabinet has two drawers, an upper and a lower one. Previous to 7.00 A. M. all checks dropped in the metal chute or mouth on top, fall into the upper drawer, and so indicate that the holder of each is on duty. As the whistle ceases to sound, the timekeeper closes the electric switch which operates a deflector so that all checks deposited after seven, go into the lower drawer, and time on these checks is computed from 8.00 A. M.

The key for these drawers is in the exclusive possession of the timekeeper. After 8 o'clock the timekeeper opens the drawers, records the numbers of the 7 and 8 o'clock checks and hangs them upon the hooks in the upper or cupboard part of the cabinet, which is then electrically locked. He then makes the round of the shop and ascertains the nature of the work each man is engaged upon, and is enabled to properly charge the time on the company's books. If a

"friend" has dropped in an absentee's check the fraud is discovered. At 12 o'clock noon, the door of the cabinet is electrically unlocked and the men, filing past, take off each his respective number. A man working during the noon hour, or after 6 P. M., is compelled by this arrangement to appear at the "time office" with a slip of paper signed by the foreman, which is evidence that the check not withdrawn by him by the time the whistle has blown has been rightfully unclaimed.

The system is spoken of as very satisfactory. The foreman or the timekeeper cannot have any favorites, or exercise any leniency toward late arrivals. If a man is on time and puts his check in, he is credited with beginning work at 7. If late even half a minute he loses the first hour and that is all about it. Several cabinets, all worked by the same switch, placed conveniently in the shop, prevent congestion or loss of time at any one point. Timekeeping is accurate, regular and satisfactory to all concerned.

Is It the Steam Engine or the Automobile?

The much-desired sermon on automobile racing against time in the streets need not fail us for lack of a text. In Nahum, the second chapter and the fourth verse, we read:

"The chariots shall rage in the streets, they shall justle one against another in the broad ways; they shall seem like torches, they shall run like the lightnings."

The gross earnings of the Chicago Great Western Railway (Maple Leaf Route) for the fourth week of September, 1902, show an increase of $16,225.81 over the corresponding week of last year, being an increase of $26,703.93 for the month.

It is reported that big improvements are to be made at the Pittsburg plant of the American Locomotive Company. It is said to be the intention to greatly increase the plant's capacity. President S. R. Callaway is quoted as saying that his company is preparing to expend large sums of money in extensions at all of the company's various plants.

We are informed that Mr. T. F. De Garmo, Eastern representative for the Falls Hollow Staybolt Co., has changed his headquarters from 3116 Clifford street, Philadelphia, Pa., to No. 60 West Ninety-third street, New York.

"Practical Shop Talks" is a very amusing book, especially for people interested in machine shop work. If you are interested in stimulating a young man to take an interest in that business, give him a copy of the book. Price, 50 cents.

Abandoning Oil as Fuel.

We supposed that oil fuel was so satisfactory that a trial was sufficient to insure its adoption. We were therefore surprised to read the following dispatch from Tacoma in the New York *Times:*

"After making a thorough test of oil as fuel on its passenger locomotives for ten months, the Southern Pacific Railroad has decided to return to the use of bituminous coal. Its mines at Carbonado to-day received orders to begin shipping 25,000 tons a month to San Francisco. Those mines have been operated by the Southern Pacific for twenty years, but were partially shut down after the road began using oil. During that time the product of the mines has been used for coke making.

"It is reported that oil was not a success on the passenger locomotives for two reasons. One was that it deposited a coating on the flues, which had to be removed every day, or it kept the heat from the water, causing a great waste of fuel. The intense heat produced by the oil also cracked and split the boiler sheets."

A Fraudulent Correspondence Institute.

A concern in Scranton, Pa., called the Correspondence Institute of America, has been prosecuted for using the mails for fraudulent purposes. The leaders of that institute, no doubt, selected the name so that people would confound them with the International Correspondence Schools, and patronize them through that misunderstanding. It is important that people should now understand distinctly that the old reliable International Correspondence Schools have no connection whatever with the concern whose chief officials are in the toils of justice. A fraudulent correspondence school is about as cruel a means of obtaining money under false pretenses as anything we have ever heard of.

The Boston & Maine people are carrying on a series of tests to demonstrate the relative expense of coal and of oil for locomotive fuel. The indications are that coal is one-third cheaper than oil.

We notice that the railroad companies running to pleasure resorts are complaining about the burden put upon them of hauling private cars belonging to railroad officials. The evil is growing rapidly and is regarded as deadheading by wholesale.

The Canadian Locomotive Works Company at Kingston, Ont., have purchased a large tract of land for the purpose of extending their works.

Packing Rings Cut Off by a Gang Tool.

The shops presided over by Mr. Robert Quayle, of the C. & N. W. Ry. at Burnside, Chicago, have in vogue a method of cutting off fourteen air pump piston packing rings at once by the use of a gang tool. The drum is turned up the required diameter and each ring is separated by a groove of a certain depth by the gang tool aforesaid. As the boring out tool trues up the inside surface of the drum, ring after ring, drops off. The surfacing, outside and inside, is done in the usual retail way by the lathe, but the cutting off is done "wholesale" so to speak, and a very considerable saving in time is the result.

A great many of our friends send us blue prints of photographs, expecting that they will appear in RAILWAY AND LOCOMOTIVE ENGINEERING. We wish to take the sting of disappointment from those friends by informing them that a blue print cannot be reproduced as an ordinary photograph can. Only silver prints can be reproduced.

Moods of Inanimate Things.

It is known to most craftsmen that not only their own muscles, but the tools with which they work are sometimes seized with something like "cramp." Old violins, for instance, at times, take fits of refusing to give out the mellow sounds which are their wont, even though played upon by a Joachim or Sarasate; and then scrape he never so cunningly, the instrument will emit nothing but discordant squeaks. At such times the violin is said to have caught cold, and probably some temporary molecular derangement has affected it. Edged tools also at intervals refuse to obey the behests of the most skillful craftsmen. The tool is then said to be "tired," and has to be laid by for a while, when it recovers its tone. Even huge machines like railway locomotives are known to go on "strike," just as do human railway servants; and experienced drivers know that at these times the locomotive cannot be compelled to work, although examination may show that it has not a crank or screw loose, a rod or rivet out of place.

Machinery is thus as liable as its drivers to get out of order, and sometimes in the most unaccountable and mysterious fashion.

The above rot is from a London paper, and is always cropping up when news is scarce. We are surprised that stories are not got out about the idiosyncracies of clothes. The meanness of collar buttons, for instance, and the pants that took cranky spells.

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Tie Plates in Soft Wood Ties.

A committee of the Roadmasters and Maintenance of Way Association has made the following report: "Tie plates, not less than 1-4-inch thick, should be used on every soft wood tie in main tracks. They should be punched to perfectly fit the rails when the spikes are driven straight, and the best results are obtained when the tie plates are imbedded in the ties before they are put in the track. This is sometimes done by a tie plate press in which two plates are set with one blow, the power used being steam. The cost per plate is from one-half to three-fourths of a cent and from 3,000 to 4,000 ties can be plated in ten hours. Another tie plating machine is operated by hand and the power is derived from an eccentric. Ten to twelve men can full plate about 1,000 ties in a day. This machine is simple and quite satisfactory. Both machines are, as a rule, only operated in material yards. We know of no satisfactory device for imbedding plates without removing the ties from the track."

The Chicago, Burlington & Quincy Railroad people are extending their car building facilities at Aurora, Ill. They are putting up one new building, 38 by 180 feet, for car building and storage of timber. Other extensions are contemplated.

A recent dispatch from New Zealand says: After having made exhaustive trials of American and British built locomotives on the Government railways, the officers report that the best results have been achieved with the American machines.

The Wabash to Build New Shops.

It is said that President Ramsey, of the Wabash, has recommended that the railroad expend between $400,000 and $500,000 on new shops for the eastern and middle division, probably to be located at Ironville.

The most valuable educational book on our list at present is Handling Locomotives, by W. O. Thompson. Many traveling engineers are using it as a text-book in examining firemen for promotion. Costs 50 cents in paper; 75 cents in leather.

The Chicago & Eastern Illinois Railroad make a practice of removing air pumps from their engines every six months, without reference to the condition of the pump. The old one comes off and a repaired one goes on as regularly as clock work. The old pump generally requires the vacation.

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Railway and Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XV. 174 Broadway, New York, December, 1902 No. 12

Baldwin Ten-Wheel Engine for the Denver & Rio Grande.

The Denver & Rio Grande Railroad have recently purchased from the Baldwin Locomotive Works some 10-wheel passenger engines which will be put to work on the mountain region between Denver, Pueblo and Salida. The idea in ordering these Vauclain engines, was that the compound feature with its economical use of steam would enable the operating department to dispense with the use of pushing engines, which, considering the character of the road operated, practically amount to double-heading each train half way over the division, and then handling a light engine to one or other divisional terminus.

The passenger engines here illustrated have cylinders 15 1-2 and 25 x 26 inches, 63-inch drivers, 68-inch boiler, and a total weight of 290,000 pounds. The air pump, though placed on the right side, is well forward and the air cylinder is slightly below the level of the running board. The blow-off cock is placed in the bottom of the boiler barrel as close to the smoke box as it can be, the discharge pipe from which comes out beside the yoke plate. The arrangement of the driving springs is interesting. The leading wheel carries its spring on a saddle in the usual way. The second spring is placed between the main and rear drivers, and bears upward against the lower frame-bar, the hangers from this spring terminate in a pair of levers, independently pivoted on the pin used to suspend the driver brake. The rear spring, which is semi-elliptical like the others, is placed below the top frame bar, behind the trailing wheel. All the driving wheels of this engine are flanged.

The tender frame is made of steel and the tender trucks are of the Sterlingworth pattern. The tank has a capacity of 6,000 gallons. A few of the principal dimensions are given below.

Cylinder, 15½ and 26 x 26. Valve, balanced piston.

BOILER.

Type, wagon top. Dia., 68 in. Staying, radial.
Thickness of sheets, ¾ and 13/16.
Working pressure, 210 lbs. Fuel, soft coal.

FIREBOX.

Material, steel. Length, 121 in. Width, 41 in.
Depth, front, 80 in.; back, 68¼ in.
Water space, front, 4½ in.; sides, 4 in.; back, 4 in.

TUBES.

Material, iron. Wire gauge, No. 11. Number, 340.
Dia., 2 in. Length, 13 ft. 8 in.

HEATING SURFACE.

Firebox	196 sq. ft
Tubes	2,418 sq. ft.
Total	2,614 sq. ft.

Grate area, 34.4 sq. ft.

DRIVING WHEELS.

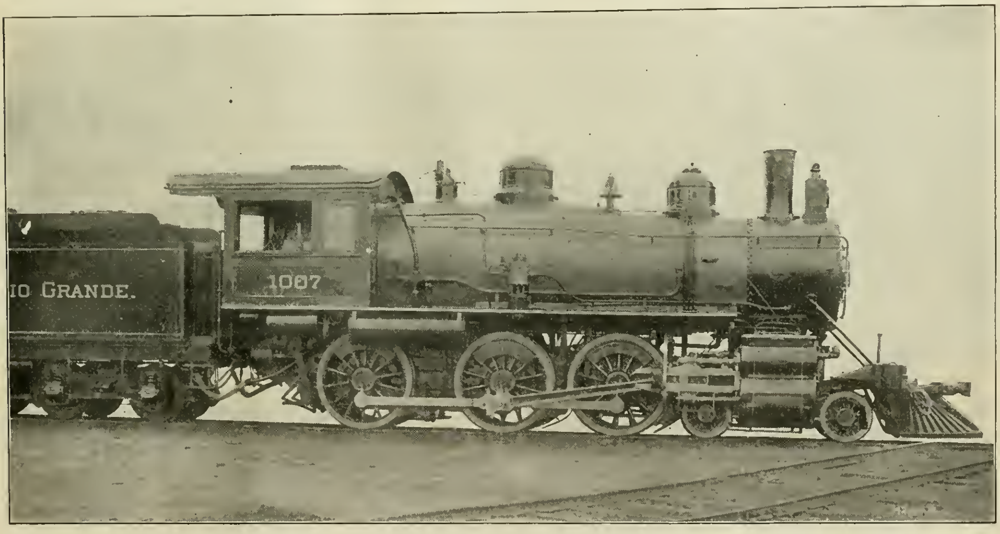
Dia., outside, 63 in. Journals, 9½ x 12 in.

ENGINE TRUCK WHEELS.

Dia., 30 in. Journals, 6 x 12 in.

WHEEL BASE.

Driving, 13 ft. 6 in.
Total engine, 24 ft. 10 in.
Total engine and tender, 53 ft. 1½ in.



BALDWIN TEN-WHEEL LOCOMOTIVE FOR THE DENVER & RIO GRANDE.

WEIGHT.

On driving wheels	131,500 lbs.
On truck, front	47,140 lbs.
Total engine	178,640 lbs.

Total engine and tender, 290,000 lbs.

It is reported that the Canadian Pacific Railway intend to test one Shay engine on a part of the line in Rossland, B. C. An order for twelve engines of the 10-wheel type has been placed with a Scotch firm of locomotive builders, and the company are said to be figuring on one thousand flat and five hundred coal cars.

New Sanding Device for Chicago & North-Western Engines.

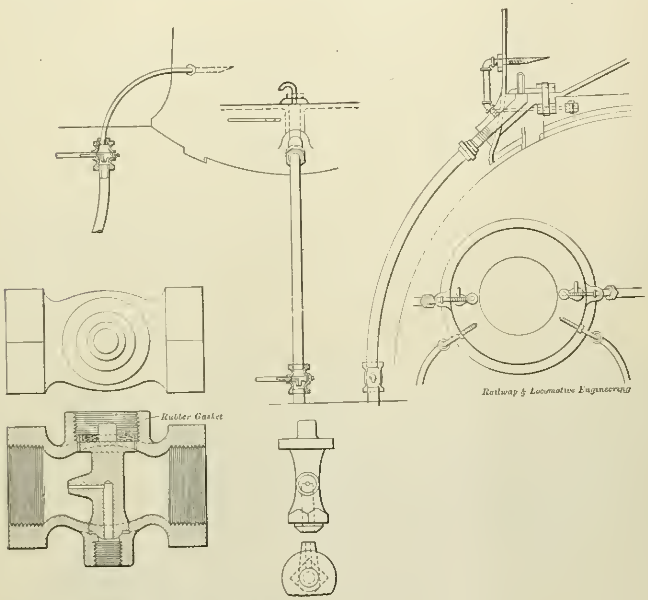
A very neat and compact pneumatic sanding arrangement has recently been devised by Messrs. Otto and Henrikson, the general foreman and the tool room foreman, respectively, of the C. & N. W. shops at Chicago, Ill. The sand-trap consists of a malleable iron cage for the air jet, very like the ordinary pipe fitting known as a "cross." Into the large ends of this cross 1 1-4-inch pipes for conveying sand are screwed, and the air nipple is inserted in the larger of the other cross openings. This nipple is made so as to form a ball joint at the side at which air enters. Back of the ball joint it fits into a square socket and cannot get out of line. After being put in the cage it is held tightly in place by the pressure of an ordinary 1-inch pipe plug which bears upon a rubber washer carried on the shoulder of the jet. Air is introduced to the cage through a 1-4-inch pipe, passes on through a 1-4-inch hole in the jet, and turns at right angles and passes out in the direction in which the sand flows, through a 3-32-inch orifice. The sand trap is thus seen to be very simple in construction and is being applied to C. & N. W. engines. The device has been patented.

The method of drawing sand into the pipe in the sand box is also very simple. The style preferred for sanding when the engine is going ahead, is to tap a 1-2-inch U-shaped pipe into the back of the hand-operated sand valve. This pipe has its open end pointing downward, 1 inch above the bottom of the box, and when the hand-valve is closed no sand can pass up the inverted U-pipe, unless drawn into it by the action of the air jet. The presence of this pipe on the back of the sliding hand-valve helps to prevent the sand caking, because when the hand-valve is operated the U-shaped pipe is moved bodily to and fro.

The "back-up" device in the sand box consists in the insertion of a piece of 1-2-inch pipe about 2 inches above the bottom of the box. This pipe is about 6 inches long and is beveled off on the under side for a distance of 3 inches. Outside the sand box this pipe leads with an easy curve into the air trap and thence the sand passes to the pipes which convey it to the rear of the trailing wheels. No sand can pass to the track by this route unless urged there by the action of the jet.

A modification of the "back-up" arrangement in the sand box may be used with the "go ahead" sander if desired. In the latter case, sharper turns in the pipes are permissible.

A trial of the jet with 85 pounds air pressure produced a lift of 41 3-4 inches of water in a 1-2-inch tube. The C. & N. W. people pronounce the Otto-Henrikson sander to be highly satisfactory in operation, easy to make, and with little or nothing about it to get out of order.



PNEUMATIC SANDING DEVICE, C. & N. W. RY.

Wireless Messages Sent to a Moving Train.

The special train from Chicago to Portland run by the Grand Trunk Railway, carrying the members of the American Association of General Passenger Ticket Agents, was arranged with apparatus capable of receiving a "Marconigram." St. Dominique station, in the Province of Quebec, was the base from which the messages were sent. On the train the electrical waves were received by collecting wires connected to the coherer. A long vertical wire would have been the ideal method, but as this was impossible on a moving train, the collecting wires were run through the guides of the train signal cord and extended about a car length each way from the coherer. At St. Dominique two large metal plate vibrators, 10 x 12 ft., were in position, connected with an induction coil of usual form. The vibration of the apparatus caused by the moving train prevented the relay from being adjusted to its most sensitive point. In spite of this handicap and the fact that the collecting wires were carried inside steel frame cars, the results obtained were very satisfactory and strong and definite signals were received on board. No attempt to rival Marconi in the matter of long distance transmission was attempted, 8 to 10 miles was the distance actually covered. Satisfaction is felt that the feat was so successfully accomplished, and greater things may be hoped for in the future.

Mechanical Stokers in Steel Mill Service.

Perhaps the severest fluctuations of load to be found in modern steam supply service are encountered in the operation of steel rolling and slabbing mills. In a recently equipped steel plant there have been put into operation slabbing mills which consume as much as 2,000 h. p. during the working of a large steel bloom. The load on the engine is approximately uniform until the bloom leaves the rolls, when it instantly falls to that of mechanical friction only. It is apparent that in order to effectually accommodate such excessive variations in steam supply, either considerable storage capacity must be provided in the boiler equipment, or quick steamers must be employed, fired by some form of mechanical stoker. At the present time the latter arrangement is rapidly coming into use, with the result that fluctuating loads are readily anticipated by control of fuel combustion. This control may be rendered automatic when mechanical draft is employed in connection with the boiler and stoker equipment. A good example of this arrangement may be seen in the plant of the Lukens Iron & Steel Co., which comprises

Saddle Tank Road Engine.

The saddle tank engine hereby shown was recently built by the Baldwin Locomotive Works for the Barre R. R. for freight service. The Barre R. R. is a short line in Vermont, whose principal business is the hauling of stone from great granite quarries. The leading dimensions of this engine are: cylinders, 17 by 24 inches; boilers, 52 inches diameter at the smallest ring. The boiler provides 1,348.4 square feet of heating surface and a grate area of 14.4 feet. The driving wheels are 50 inches outside diameter, and the main journals are 8 by 8 inches. The rigid wheel base is 10 feet, total wheel base 18 feet 6 inches. The engine weighs 110,000 pounds, 96,000 pounds of that being on the driving wheels.

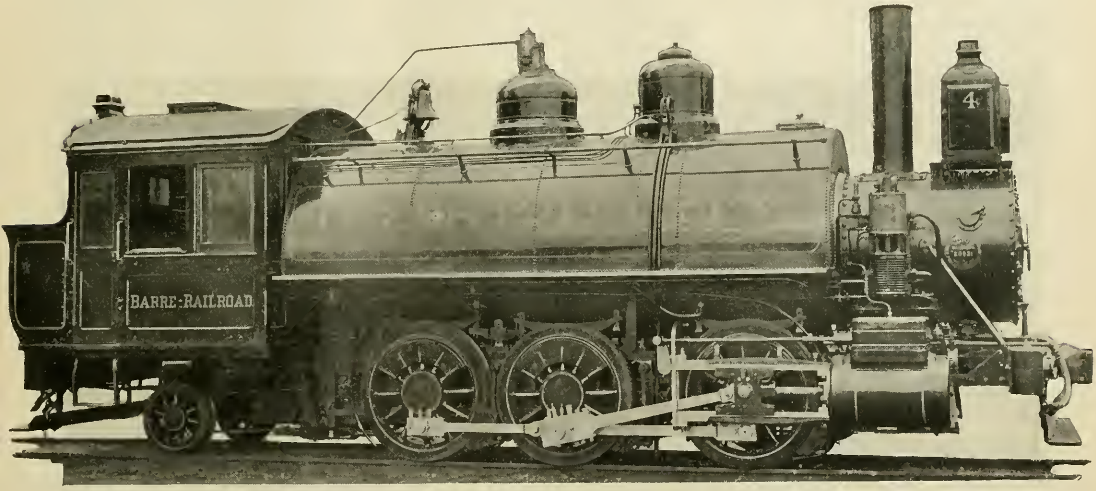
ticularly with suburban trains. This will be more especially the case if it is decided to depress the tracks from the outside tunnels so that the suburban traffic may run continuously through a loop depressed under the present floor of the Grand Central Station. In any case it may be taken for granted that the New York Central will no longer remain under the reproach of not making every effort to develop the possibilities of its magnificent suburban traffic.

The Standardization of Rod-Bolts.

When an engine is going through the repair shop the renewal of rod bolts is one of the items which has to be attended to. A reamer is usually run through strap and rod, and the new bolts are made to fit the hole which has just been "cleaned up" by the reamer. A good deal of running about and considerable "cut and try" is, of course, incidental to this method. At the Chicago shops of the C. & N. W. Ry., what may be called the standardization of this work has been lately accomplished. Rod bolts for repair work are now made in a lathe, having the taper adopted as standard in the shop. The lathe man turns these bolts out one after the other as stock material, and before the engines for which they are intended have come in off the road.

The standardization of the work consists in providing the lathe man with a set of gauges, bored out standard taper, each increasing in size by 1-32 of an inch. The bolt he makes is considered to be of standard size when the gauge will slip up on it to within 3-8 inch of the head. All this is simple enough, but the standardization of the holes has to follow as a matter of course.

When the rod and strap comes to be reamed out the man with the reamer slips on it a taper gauge marked with size, similar in form to the one used by the lathe man. At some point on the standard reamer this gauge catches and holds tight. The portion of the reamer below the gauge therefore becomes a reamer which will clean up a hole to suit the bolt made by the lathe man when he used a similarly marked gauge. If the portion of the reamer below this slipped-on gauge is long enough for rod and strap it may be used; if not, a larger gauge, giving longer reamer, is required. In this way it is possible to ream holes only to sizes for which there are bolts already in stock. There is no measuring or making a fit. The gauge on the reamer, stamped with the size of the corresponding bolt, and a card index of bolt diameter and length, give the information necessary to fill out a requisition, and what may be called "lost time" has entirely disappeared from the operation.



SADDLE TANK ROAD ENGINE.

N. Y. Central to Operate by Electricity.

As already announced, the New York Central & Hudson River R. R. is making extensive plans to convert its present steam service running into the Grand Central Station into an electrical service. It is contemplated to abolish steam altogether as far out as Croton on the Hudson River Division and as far as White Plains, on the Harlem Division. The local service from these points will ultimately be run with specially made cars having motors attached to the axles much the same as those in use at present on the Elevated Railway in New York City. All the heavy through trains will be taken by electric locomotives, which will haul them into the Grand Central Station and back again to the point of changing over to steam locomotives. With the disappearance of smoke from the tunnel, it will be possible to give a much faster and more regular service than has hitherto been the case, par-

Efficiency of Boiler Joints.

The weakest part of a boiler shell is the longitudinal seam. This cannot, of course, be made as strong as the solid plate with any riveted construction, but a good design of joint employing multiple rows of rivets and cover plates, will closely approximate it. The Lukens Iron and Steel Company recently equipped their new power plant with horizontal tubular boilers having quadruple-riveted longitudinal seams. These are calculated to have not less than 94 per cent. of the strength of the solid plate. Mr. Samuel Vauclain, superin-

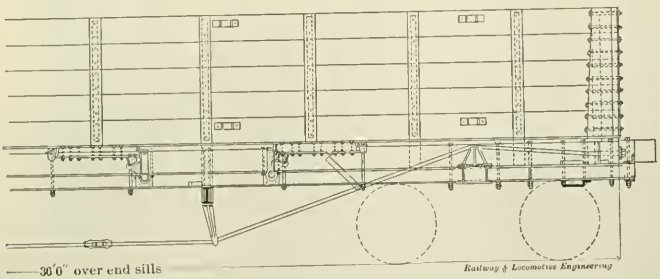
tendent of the Baldwin Locomotive Works, has recently patented a design of boiler joint that has a calculated efficiency of 96 per cent. The weakening of the shell depends on how much of the material is cut away by the rivet holes; the smaller the holes the less it is weakened. This fact may make the use of nickel-steel rivets advisable in boiler construction where a high seam efficiency is necessary. The engineer of tests at the Bethlehem Steel Company has demonstrated that a nickel-steel rivet 3-4-inch in diameter is as effective as a 1 1-8-inch rivet made of common steel.—*Ex.*

"Six Door" Gondola on the L. S. & M. S. Ry.

When preparing the illustration for this L. S. & M. S. coal car, we were humorously reminded by a friend, that such cars had, once upon a time, been very useful in railroad service. In the hope that coal cars will not become entirely obsolete we here present, through the courtesy of Mr. H. F. Ball, S.M.P., a gondola, in designing which, the aim was to provide a car with a flat bottom, suitable for handling merchandise coal on side tracks, where it has to be shoveled from car to wagon. The car is also intended for handling structural steel, billets, etc., and is intended to dump as large a percentage of load as possible, in cases where it is desired to unload through the bottom of the car. The six-door arrangement in this car permits about 44 per cent. of a load of bituminous coal to be dumped out.

The car is very substantially built, the stakes being placed inside the car sides give maximum floor area for the spread of the sills. The stakes in the central portion of the car are carried down to the level of the underside of the needle beams, which makes a strong stiff form of construction. This is reinforced by tie rods at each stake pocket from sill to sill, all of which is intended to resist side bulging, and the sills being deeply trussed with six rods, the tendency to sag in the middle is provided for. The car has a capacity of 90,000 pounds.

The bolsters, which are made of steel channels, were designed with a view of carrying practically the entire load on the side bearings. This was done in order to reduce the weight of the bolsters, and thereby help to cut down the total weight of the car so as to permit the use of 5x9 journals. The car weighs about 35,000 pounds. Yellow pine was used for flooring and side planks. About 95,000 pounds run of mine coal can be carried in these cars. The sides of the car are 4 feet 5 inches high, the inside width is 9 feet 8 inches, and the length inside is 35 feet 7 1-2 inches, giving a volume of about 1,534 cubic feet, as the dumping doors when closed are flush with the bottom of the car.



"SIX DOOR" GONDOLA—L. S. & M. S. Ry

New Fire Resisting Material.

The latest fire resisting material to claim the attention of engineers is known as uralite, because its inventor, an officer of the Russian army, was stationed near the Ural mountains. A part of its substance, asbestos, comes from that quarter of the world. The asbestos is ground to pulp and mixed with about 30 per cent. of chalk, and, after passing through various chemical processes, appears in the form of tough, pliable strips. Gelatinous silica is employed as a cementing substance, about 20 per cent. being used, thus leaving the proportion of asbestos about one-half of the total. The boards made from this substance are tough and will stand a large amount of wear and tear, but their chief interest arises from the fact that they appear to be utterly impervious to fire. They may be planed or sawed like ordinary wood, and glued or nailed with equal facility. Numerous experiments have been made with this uralite, all intended to demonstrate its superior qualities as a fire resistant, and all appear to have been successful. Doors made of it have withstood extreme temperatures without injury. As a material for constructing file boxes and in various other ways where papers are to be preserved, it should have a large field of usefulness.—*Iron Age.* If the claims put forward for this substance are made good, uralite should be a good substance with which to make round house doors, sheds for sand driers and the like. Perhaps the chalky matter extracted from water by some of the water softening processes used on railways, could be used as one of the constituents of this new fire resister.

Air Jack at Wheel Press.

A neat application of compressed air is used at the Toronto Junction shops of the Canadian Pacific, in connection with the wheel press. When the axle is brought to the press, instead of being hung from the horizontal beam of the machine, it is supported on what is practically a permanently placed small air jack, situated two or three feet in front of the press. The axle can be raised to the required height by the operator pressing his foot on a button in the floor very much like that by which a motorman on a street car rings his gong. When the axle is upon the air jack, the wheels are rolled to position and entered. Two iron rack plates on the flood allow the wheels to easily slip in toward the wheel seats when urged thither by pinch bars, whose points engage with the teeth of the rack. When the wheels have been pushed in a sufficient distance by hand, the air jack is lowered and the wheels and axle roll forward to the press, where the operation is completed.

Novel Drawing Table.

An illuminated tracing table has recently been installed in a Boston drawing office, for making tracings on thick paper from drawings having weak lines. A large drawer fits under the top of the table, a rectangular hole being cut in the latter and a large piece of French plate glass set in. In this drawer is a cluster of incandescent lights with a white porcelain reflector. This cluster may be moved to any portion of the drawer, so as to come under that part of the drawing which has most need of it, the illumination not being uniform all over the drawing. A great variety of uses has been found for this equipment, such as comparison of alternative designs and the tracing of additions directly on brown paper drawings or blue prints.—*Ex.*

The four main cables of the new East River Bridge, New York, are probably the largest in the world, being 18 inches in diameter, 3,000 feet long and weighing 2,500,000 pounds each. Composed of some 10,400 straight steel wires, each cable has an ultimate strength of about 50,000,000 pounds. The wires are 3-16 inch in diameter. The cables are to be covered with a water tight cylinder of sheet steel. Some of these cables were badly injured by a fire early in November.

General Correspondence.

Fitting Up Driving Rod Brasses.

The first step after receiving the brasses from the foundry is to plane the flanges *a a*, Fig. 1, of each half brass, taking off only enough to clean them up, when the opposite face *b*, Fig. 2, is flat down on the planer bed or table of the shaper, as the case may be. The flanges *a a*, Fig. 1, should now be put on the planer bed and a cut taken off the face *b*, Fig. 2. The two planed parts of the brass are now perfectly parallel, which will be of assistance later.

When all the half brasses have been subjected to the operation described they are ready for the tinner to "sweat" the faces *b*, Fig. 2, together. From the tin-shop they should go back to the planer and be placed on the bed with the side *c*, Fig. 2 (no difference which side), down. Take just enough off the other side to clean it up.

In Figs. 3 and 4 is shown a special chuck for holding the brasses while planing them to fit the straps.

In Fig. 3, *a a*, is a stud with a collar *b*, forged on it, near the outer edge of which are four 7/8-inch holes, shown also at *a* in Fig. 4. These holes are exactly 90 degrees apart.

On one end of this stud are two steel collars *c c'*, Fig. 3, which are a sliding fit on the stud. The other end of the stud fits the hole in the bracket *b*, Fig. 4, just loose enough to turn without the aid of a wrench.

Holes are provided for holding the bracket to the planer bed, or to the table of a shaper, and it should be bolted on with the stud at right angles to the direction of the cutting tool, and also parallel with the bed or table.

Having fastened the chuck to the machine properly, remove the nut *f*, and collar *c*, and put the brass on the stud with the faced side next to the collar *c* and the flanges *a a*, Fig. 1, perpendicular to the planer bed.

Now plane half enough off the top to fit it to the strap, and enough off the insides of the flanges to make it fit the strap, taking an equal amount off each flange.

Having finished this part of the work, loosen the nut *e* and remove the open washer *d*, which will permit the stud *a* to move endwise far enough to let the collar *b* clear the stud *g*, when the brass can be turned bottom side up without disturbing the nut *f*, which will bring the hole *h* opposite the stud *g*. Replace the washer and tighten the nut *e*. Proceed with this side of the brass the same as before, and if the holes in collar *b* are exactly 90 degrees apart, the two sides of the brass now planed will be parallel, as they should be. Loosen the nut *e* again and turn the stud *a* one-quarter turn either way, and plane one end of the brass, then turn the stud one-half revolution and plane the other end.

Thus the brass is planed on all four sides without loosening the nut *f*. After the brasses have been planed to fit the strap and the oil holes drilled, heat them enough to melt the solder that holds the halves together, to separate them. Remove what solder adheres to them, then put them in the strap, and put the straps in place on the rods. Put a center in each brass to be used in laying out the brasses for boring. Set a tram to the length of the rod, then with one point in the center of, say the black brass, draw a line across the center in the other brass. Suppose this line to be 1/8 in. back of the center of the brass, then move the back center 1-16 in. ahead and draw another line with the tram across the center in the front brass. This line will now be 1-16 in. instead of 1/8 in. back of the center of the front brass, but the difference between the right length of the rod and the distance between the centers of the brasses has been divided between both ends of the rod.

With a pair of dividers scribe a circle somewhat larger than the pin around the centers, for use when setting the brasses up in the lathe or boring mill.

Main rod brasses should be bored 1-64 in. larger than the pin and given 1-64 in. lateral or side motion, being careful to have the flanges the same thickness on each side of the strap. To prevent the brasses wearing themselves loose in the strap, they should fit it tight enough to require three or four blows of a hand hammer to drive it to its place in the strap, using a block of hard wood between hammer and brass. But the ends of the strap should not be sprung open more than 1-32 in. when the brass is home.

When strap rods are used for side rods, the brasses should be 1-32 in. larger than the pins, and have 1-64 in. side motion. After boring out and facing the sides, take the brasses out of the straps and fit them to the pins, being careful to have no bearing on the fillets.

Solid side rod brasses should be turned enough larger than the hole in the rod to require 1½ tons per inch of the outside diameter of the brass to press it into the rod. When the brasses are bored out before putting them in the rod, allowance should be made for the compression due to forcing the brass into the rod.

When the engine frames are in a position to become heated from the boiler or ash pan, the side rods should be 1-64 or 1-32 in. longer (according to the temperature of the frame) between centers than the distance between centers of axles, when the frame and rod have the same temperature. All strap rod brasses should be brass to brass, and the keys driven down enough to hold them that way, but not enough to spring the brass out of shape.

To find the length between centers of brasses, of the main rod, place the crosshead midway between striking points. Then the distance between the center of

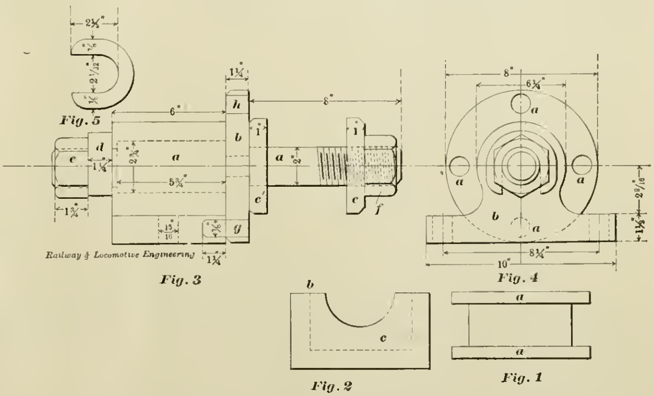


Fig. 5 Fig. 3 Fig. 4 Fig. 2 Fig. 1

cross-head pin and center of main axle is the length of main rod.

IRA A. MOORE.

Cedar Rapids, Ia.

The Indicator as an Educator in Steam Engine Practice.

Since the steam engine indicator has come into such general use in steam engine practice, it is important that the engineer in charge of such plants should possess sufficient intelligence so as to be capable of being taught how to use it and how the action of the steam in the cylinder is reproduced on the indicator diagram.

The machine shop apprentice should also be able, if asked, to analyze the indicator card, which will tend to widen his field of usefulness, as the more he knows about such questions aside from his work of learning the trade, the more valuable his services will be, and every increment of knowledge that adds to the possible efficiency of his apprenticeship will be fully recognized by his employers.

The engineer or apprentice can obtain a text book of instruction on the use of the indicator, which may be read and re-read with some interest, but he is unable to make the different lines clear to himself, and the true value of such a book is appreciated only when it is followed up by the personal instruction of some fairly intelligent person, who has operated the instrument and thoroughly understands the lines of the card, and is able to intelligently associate them with the corresponding points in the valve motion, and when intelligently handled, so far as the valve motion and steam distribution are concerned, shows how nearly the actual conditions approach well worked out theoretical conditions of efficiency.

There are, however, some railroad men and others, who claim that the work done by the indicator is not reliable.

From a very large number of tests made both in stationary and locomotive practice, the indicator has been found to be absolutely correct and reliable in the measurement of the steam distribution in the cylinders, and the accuracy of its indications are practically unquestionable.

It would be money well expended by every well-regulated steam power plant to have as a part of its regular equipment some standard make of indicator and the necessary rigging, so that cards could be taken periodically so as to give the information for keeping the valve motion in good condition, and indicate exactly what is going on inside the cylinders; and the engineer thus becomes acquainted with the several lines of the card, so that he may be better acquainted with the machine he is taking care of, which would also invite more interest on his part in the care of the plant.

We are living in an age of progress and the efforts of men to excel each other in their work creates rivalry, and consequently a greater zeal in working for the best interests of their employer.

The accompanying indicator cards illustrate very intelligently the value of the indicator in discovering defective operation of the steam engine. These cards were taken from a 12 x 12-inch 75 horse power Armington and Sims engine in a modern power plant, operating two belted dynamos of 25 kilowatts each, after the engineer had complained that the engine was erratic and that the electric voltage could not be kept constant. The r. p. m. 280 and boiler pressure 95 pounds per square inch.

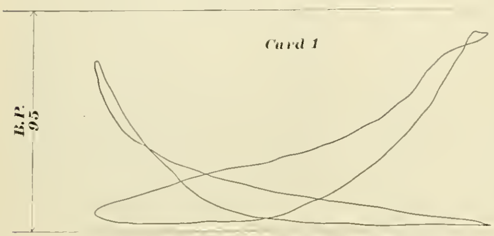
Card No. 1 was taken when the engine was running the dynamo light, and represents the friction of the engine, dynamos and belts. The valve motion is very badly distorted as will be seen by the card.

Card No. 2 was taken when the engine was working under about one-half load, and the valve motion in the same condition as in Card No. 1.

Card No. 3 was taken under the same conditions of load as Card No. 1 after an adjustment of the valve gear had been made.

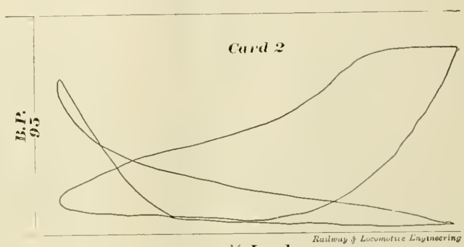
Card No. 4 was taken under practically similar conditions of load as card No. 2, after having made all the adjustments to the valve gear, and it will be noticed that the distortion of the valve motion is entirely eliminated, and also that the

Before Adjustment



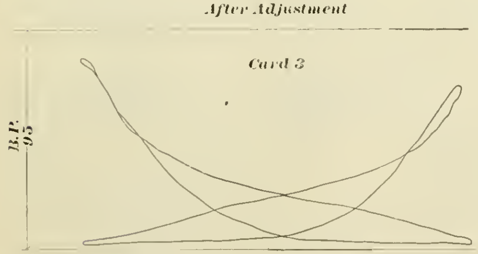
Running Light & 2-25 K.W. Dynamos

Railway & Locomotive Engineering



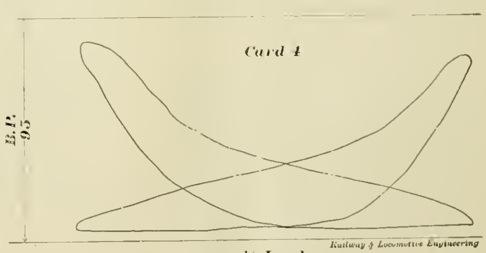
½ Load

After Adjustment



Running Light & 2-25 K.W. Dynamos

Railway & Locomotive Engineering



½ Load

work done in the two ends of the cylinder is fairly well equalized.

Card No. 4, however, shows a little rounding at the beginning of the stroke, which indicates that the engine is slightly deficient in lead, and that the eccentrics should be slightly advanced, which would also reduce the back pressure due to the earlier release.

The back pressure, as shown by all the cards, is a little high, but this is accounted for by the fact that the engine exhausted with three other engines, through a long pipe into a feed water heater.

This story is written with a view to bringing out the value of the indicator as a correcter of erratic valve gear and at a very small expense.

S. J. Dillon.

Jersey City, N. J.

Care N. S. Hayward, Supt. M. P. P. R. R.

Comparative Sheets.

Comparative sheets, comparative reports, comparative pictures, either pen, word or photographic; comparative reports of railroads, municipalities, states, nations and peoples; form the basis of the fundamental laws governing the universe. Drop the comparative statement, of whatever form, and you have dropped the most important link that binds us together and propels or impels our most intricate system of being, moving and living.

Comparative sheets are compiled to serve two purposes. First, to satisfy the successful, to compliment the able and to stimulate the industrious, if less fortunate, operative. Second, to shame the careless, to put on exhibition the negligent, and to show just cause for removing the perverse and incompetent.

The compilation and exhibition of such sheets serve to set in motion all the human, mental, attributes or emotions; such as pride in a duty well performed and thus recognized, strife, which impels greater effort to maintain laurels already won, or to gain achievements known or thought to be possible. The successful, cause envy, chagrin, sorrow, hatred, malice and kindred emotions. The unsuccessful, provoke solicitude, their lack of mental or physical ability is deplored; perverseness is condemned and a careful study of the whole forms the basis of all action; brings honor or dishonor, promotion or demotion, rewards well directed ambition and punishes culpability.

VALUE OF PERFORMANCE SHEETS.

There is probably no place where performance sheets, if correctly, plainly and honestly compiled, are of more value or will pay a greater dividend on the investment than on our American railroads, where, as everywhere, there are two classes of men always awaiting the issuance of the comparative sheet, the one, with a well satisfied expectation, is confident of seeing well directed effort verified; the other, with the same degree of expectancy, awaits the publication of mis-directed energy. If the sheet contains no flaws, the one man is proud of his performance, he shows the sheet to his friends and invariably calls attention to the standing of his less fortunate competitors, and a healthy degree of rivalry is produced, the value of which would be hard to estimate and which applies to all branches and all classes.

So who will say that the performance sheet is not essential, that it is wrong or unjust to set in motion these various emotions, that keep us from dying of ennui or becoming all of one class, lacking the traits which constitute our much boasted of, personality.

It will not be the purpose of this article to go into minute details, showing the shortcomings of the average performance sheet, which are apparent to everyone at all conversant with making or using them as a basis of calculation; or furnishing a copy of the various forms which might be substituted.

FALSE PERFORMANCE SHEETS.

A careful examination of the performance sheet of your division or road or system will in most cases furnish food for reflection. It will show you in many cases that the aim has been to shift instead of shoulder responsibilities. That in many cases the performance sheet simply shows the wishes of the compilers rather than the actual performance as should be shown.

While the performance sheet which cannot be disproved is of inestimable worth, the one containing any flaws of no matter how trivial a nature, is worse than nothing and represents not only the loss of time and expense of compilation, but serves to engender a feeling among the rank and file not in accord with what is expected by the issuance. Why should a performance sheet show the cost per mile run on two roads, or systems or divisions, where wages of workmen are different, where the cost of fuel is not the same and may be double, where the climatic influences play a no small part in the cost, where the class of power is different, large or small, good or bad, old or new, compound or straight; where the average load may be one thousand tons or two thousand, where the weight of locomotive and caboose in one case is considered a part of the rating and in the other it is not? Where one has a first-class roadbed and heavy steel, while the other is in need of a good roadmaster, with men and material to demonstrate his ability as such.

COMPLICATED SHEETS.

The value of the performance sheet is too often lost by its being so complicated that the average man cannot or will not attempt to decipher it on account of its complexity. The compilor by reason of his familiarity with the subject may think it perfectly plain, yet we doubt not but that he would be as much at sea if given a performance sheet of a foreign line to look over, as are we with his. He might like us be compelled to ask questions which he in his position would be loth to do, as we are with him. The performance sheet to be of the most value should be as plain to read as a magazine article if we have to ask many questions, we probably won't. We would rather remain in blissful ignorance than to exhibit it to others.

SHIFTING RESPONSIBILITY.

We were commanded by the book we used to read before we started railroading, to bear each other's burdens, we now have burdens of our own, usually full tonnage, so we don't want to carry more than our just rating; in other words, we want a uniform performance sheet; if we deserve a handicap, we want it. If stopping to clean a dirty fire on our division constitutes an engine failure, we hope to see the same rule apply on an adjoining division; it will look better in the general office where efficiency is measured by the performance sheet. If one man or division makes an oil record by the use of hot box grease instead of using oil, we want a barrel of hot box dope right away. If one man runs faster or pulls more than we do, we want a similar machine or an allowance. If he can do more work of any kind in the shop or on the road you will have to prove it by a performance sheet which has no loopholes in it through which we may crawl.

THE LOCAL SHEET.

Did you ever get real mad when the Supt. M. P. and the oil man got after you about your division sheet and make up your mind to give all hands a jacking up? You first lit on Bill Trueman. You said, "Here, Bill, you fell clear down on coal as to miles per ton and as to 10,000 ton miles."

He said, "Yes, the sheet looks bad, but it isn't correct. You know those dagoes never fill the buckets anywhere near the same. At the other end, they guess at it, and they never come within a ton of being right; and at the middle coaling station, where they have the bunkers, it is still worse. If you remember, I reported a case along about the middle of the month, when my engine was charged up with 11 tons, and the tender only holds 9 Besides, I had 2 tons on the tender when I came in. In this case you went hunting, and the other man had all the ammunition. Then you dropped the coal question and tackled Al Johnston for only making 60 miles per pint of valve oil, when he should have made 160. He

answered that it might have been due to the fact, as it was once before, that the valve oil can in the store room sprung aleak and you distributed to all engines the loss. I asked you to provide lockers for us where the men on connecting divisions were stealing our oil; I just kept track this month and they stole 8 pints from my engine. They even drained the lubricator to get it. I was expecting you to call attention to my poor record, but I think I made as good a record as any man on the division if the sheet showed my actual performance. Again you went fishing without bait, and you wished you hadn't.

EXTENDED USES.

There is no limit to the uses of the comparative sheet until every branch is covered, until the day's work of each mechanic has been compared and the performance of individuals, gangs, division and systems are placed side by side with due allowance for the uncontrollable items. Performance sheets should be simple, they should show but one thing per sheet. We find a large complicated sheet covering a square yard of paper, and showing all items of expense from the pints of illuminating oils used per 10,000 tons of freight hauled one mile, net and gross, to the total columns showing in dollars and cents the total expense of running a railroad system; in many cases is looked upon and examined with the same degree of interest and understanding that we bestow on the printed tablets illustrated in the Sunday morning paper purporting to be the key to the Greek language or the history of the Ptolemys. We don't wish to be understood as ridiculing the ordinary performance sheets, or underrating their value, but rather make the plea for a greater number and of a less complex form, absolute correctness being indispensable to make them of value. For illustration we may say that every man excels all others in some branch. That if a system of reports or sheets were issued and exhibited covering detail work, it would be of far more importance than the total column. Take care of the details and the totals will take care of themselves, like taking care of dimes removes the necessity of looking after dollars.

Each individual, or gang, or division reduces the cost of some detail by superior methods, but the value in one case is lost by poor methods in another. A saving may be made in the manufacture of a bolt and the amount lost by the driving of a rivet. In this case the total column simply shows equality when compared with similar work of comparable classes. The total column is not the one over which the battle should be fought. It is a deplorable fact that in many cases complimentary performance sheets are not issued, and if issued are not commented upon by officialdom, while the reverse conditions rarely escape; yet the former would be of equal, if not greater, value to the individual or class, if the same interest was shown in them.

In conclusion we may safely say that most men would court the issuance of the performance sheet, if it was absolute and their just measure was shown by it. They would then strive to head the list at all times and their best efforts would be secured; while if there are any loopholes through which they may crawl they lose all respect and all interest in the sheet. There are 1,396,000,000 people

EFFECT OF A LAP ORDER ON TWO EXPRESS TRAINS.

always looking for the belt or parchment, medal or certificate, or whatever token marks superiority.

D. P. Kellogg.

Oakland, Cal.

Repairing an Intercepting Valve.

Enclosed please find sketch of one of several intercepting valves, in which cracks showed up. These cracks, I am disposed to think, were from contraction rather than from service, as all of them cracked in the same place. Figs. 1 and 2 show side and top view of valve. A A A, in Figs. 1 and 2, show about the location of crack in cylindrical part of valve, and which was on either side of the valve, but only extending part way around. As we look into the end of the valve, the cracks B B, Fig. 3, appear. The job of repairing these valves was given to the writer, and he was to use his own judgment. Knowing that a patch could not go on the outside, and that provision must be made on the inside, for the movement of the separate exhaust valve when working single expansion, and repairs were made accordingly. The back end of valve was caught in the lathe chuck, and a steady rest set at C, Fig. 1. The fractured end was then bored out, just to true it, and the bottom faced, leaving as much fillet as possible in the corner. A patch of 3-16 steel, like Fig. 4, was then cut out; the diameter H being 3-8 less than the diameter of the bore. The three arms, 1, 2, 3, were made 1 1-4 wide; the arm 4, 1 in. wide, with a T-end 1 x 1-2. A casting the size of diameter H was used as a former, to bend the arms at right angles to the bottom. The arms can be hammered to shape, so they will fit very nicely to the bore. You will notice at G, Fig. 2, there is a fracture, the valve being very weak at this point, you will see the idea of the T-end of arm 4.

Fig. 1

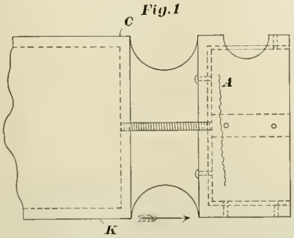


Fig. 3

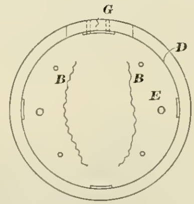


Fig. 2

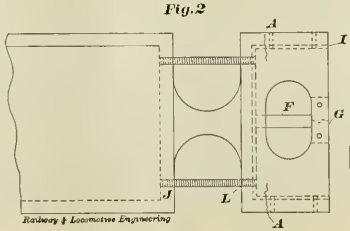
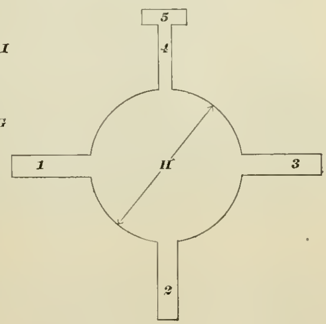


Fig. 4



The 1 in. size of arm 4 was, that as little obstruction to the separate exhaust passage be made; you will notice that it crosses the opening shown in Fig. 2. When the patch is nicely fitted in, it is held in place by four 3-8 rivets. As there is no room for rivet heads, the rivets through the arms are taped 3-8, and rivets screwed in tight. After the patch is riveted in (the dotted line I, Fig. 2, shows it in place), we stand the valve on end, and drill and tap for the two stay bolts J, as shown in Fig. 2. These stay bolts are 5-8 12-thread, and call for a special tap. When stay bolts are screwed in tight and the thread upset at Z, Fig. 2, so they will not start, the valve is again put in the lathe, and the tool set at K, Fig. 1, and a cut run in the direction of the arrow. It will be found that the fractured end of the valve does not run true, so the tool will take off any high places and put the valve all in line. The end of valve should then be faced off square. So far as the working of the engine is concerned, it is not known that anything ever happened to the valve. This repair job is one that is worth doing well, and I have no hesitation in saying that the valve is stronger after repairing than in its original condition.

W. de Sanno.

815 Van Ness Avenue, San Francisco.

Why Do Trains Get Stalled?

If an engine is rated for a certain number of tons at a given speed, and can make it all right one time and not the next, and you are called on to give the reason, what should be your excuse? Now, if a number of cars needed oiling, though no hot boxes would show up on the train, they would haul harder. If the cars did not swivel easy, "as anything that has motion tends to go in a straight line," the flange friction on curves would be more, another cause for hauling hard.

Some of the cars in train may not be weighed, just guessed at; perhaps he was a good guesser, and perhaps not. But one thing we are sure of, the power of steam at a given pressure is constant, and the leverage of engine is always the same.

I have often thought it would be the right way to weigh a train that was all right in every way, get what the engine was good for, and then if she made steam and could not get over, ask some one else the why? Engineers do not get stalled for fun. Most of them that I know like to tell how many tons they took over the Hill with the 244.

There is one way I make up my mind what is the matter. If, after I drop over the Hill the train runs free down hill, train is heavy. If they do not drift free cars run hard.

L. W. Tighe.

5 Vernon street, Nashua, N. H.

Poor Way to Preserve Clams.

Apropos of the matter of a location for the Master Mechanics' Convention in 1903 a story is told on a man, long a bright light in past conventions, who has since passed over to his reward. This gentleman was for years at the head of the mechanical department of one of the snuggest little roads in the Middle West, and while his boyhood days were spent in the East, he had not visited the sea coast for years.

While attending a gathering at Old Point Comfort under the tutelage of a certain supply man, an old and intimate friend, who loved good liquor as much as the master mechanic hated it, the party were regaled with an almost forgotten luxury, a clambake. The clams tasted so delicious and brought back so many pleasant recollections that the M. M. possibly ate too many, and at ten that night he was fast becoming a sick man. Of course, his "guide, philosopher and friend," the supply man, was on hand, as also a doctor, who at once inquired, "What did you eat?" "Clams," was the reply. "Anything else?" "No. only clams," was the weak reply. The supply man here took a hand by remark-

ing, "If you ate nothing but clams, there is something wrong; what did you drink?" "Water," the sick man answered. A shadow of mingled pity and disgust flitted over the supply man's face, as he said, "No wonder you are sick. A man who will try to pickle clams in cold water is a —— fool. John, you ought to die." E. McA.

First Compound Locomotive.

New York, Nov. 3, 1902.

While in Mexico lately, I saw your October issue, and on page 423 it is stated the compound locomotive is 25 years old, and that the first compounds were made 25 years ago in France.

I beg to state for the information of your readers that probably the first compound locomotive was made in 1868 at Percy-Main-on-Tyne, Northumberland, England, not far from where the first practical locomotive engine was made by George Stephenson. It is thus 34 years since the Percy Main compound was built, 9 years before the French compound mentioned in your paper.

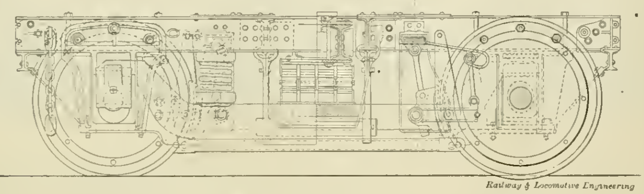
J. L. Angus,
Mechanical Engineer.

[The item which our correspondent refers to was not correct, but he is also away behind on the history of compounds. In 1844 Thomas Craddock experimented in England with a compound locomotive. In 1850 the Nicholson-Samuels compound was run for some time. A compound locomotive was built in 1867 in Buffalo, N. Y., and was used for some time on the Erie Railroad. We publish a book on compound locomotives which gives a fairly correct history. It also contains other information that every mechanical engineer ought to know.—Ed.]

Passenger Truck with Steel Frame.

The Lake Shore & Michigan Southern Railway, some time ago, designed and put into service some 4-wheel, steel frame, baggage car trucks, which after fair trial have given excellent results. The wheel pieces, transoms and bolsters are made of 8-inch I-beams. The end beams of the frame are 5-inch I-beams, while the brakes are hung from steel channels, which act as additional stiffeners between the side frames. In the truck there are only three rolled sections, which are, of course, easily procurable from any steel mill.

The object of this design was to do away with the six-wheel truck which had formerly been used under 60-foot baggage and mail cars, and to substitute a four-wheel truck which would answer as well. The truck can be applied to all this class of equipment where the weight is such that usually a six-wheel truck with 4 1-4 by 8-inch journals would be required. The two axles used in the steel truck have 5 by 9-inch journals. Four mail cars have been in constant service with the steel truck since January, 1901, and the design then adopted has in every way justified anticipations. The hangers have a forked upper end, which grasps a steel casting on each side of the I-beam forming the transom. These castings are carried back to the side frames, and when flared out unite side frames and transoms in a very strong and compact way. Steel plates at an angle of 45 degrees on the top of these members prevent any tendency to rack. The outer corners of the truck are also well braced with the same end in view. This form of construction has one very decided advantage, which is that when the cars go through the shops for a general overhauling the trucks are found to be perfectly square, and do not require squaring up again, as is usually the case with wooden frame trucks. This means reduced cost for maintenance, but it is not only in the elimination of periodic squarings that this truck "scores." Being perfectly square all the time in service, it does away with all the flange and tire wear which takes place little by little with the ordinary truck during the time it is gradually "running down" to the repair point. The omission of one pair of wheels with axle in this truck also possesses economical features both in maintenance and operation. The wheel base is 8 feet, while the total over all length of the frame is 11 feet 10 inches. The truck is simple in construction, durable and economical in service, and reduces the items for maintenance charge on the company's ledger to a minimum. We are enabled to present this design to our readers through the courtesy of Mr. H. F. Ball, Superintendent of Motive Power.



STEEL FRAME PASSENGER CAR TRUCK—L. S. & M. S. RY.

Aids to Valve Setting.

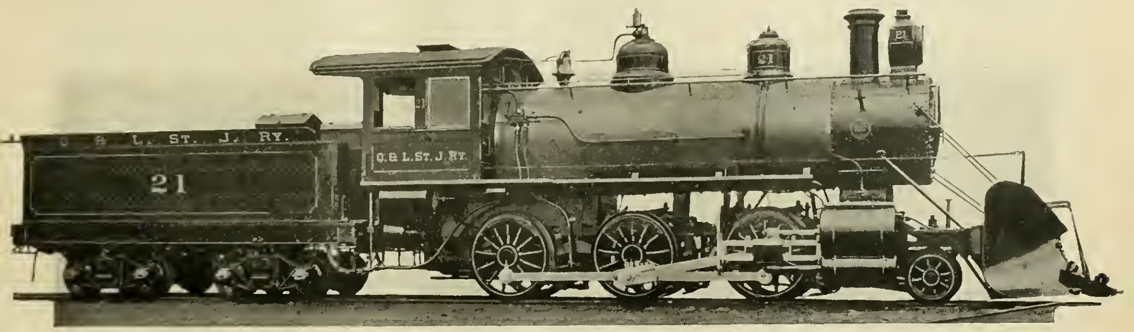
I notice in your issue of September a communication headed "Valve Setting by Air," also cut of a contrivance which consists of rollers with air motor attachment for which the designer claims advantage over the old style system of pinch bar. The time he gives for the air motor attachment in setting a pair of valves is four hours with two men. This is an advantage of eight hours and the saving of four men, which he claims took six men twelve hours with the pinch bar method. Now if it were absolutely necessary to square a pair of valves by the latter process, the air motor attachment to the roller would be quite a saving. But as neither the rollers with motor or pinch bars are necessary to square a set of valves, and under ordinary conditions the valves can be adjusted in from ten to thirty minutes, which shows a saving of three hours and thirty minutes in one case and eleven hours and thirty minutes in the other, so from this it appears that although the motor is quite a saving on the old pinch bar method, yet it is expensive because it is unnecessary. But as hundreds of railroads are still using the pinch bars the inventor deserves great credit for his attachment. The master mechanics or foremen seem not to attach much importance to this matter, and some I know have but a very limited knowledge of valve motion, yet on a large system the loss is enormous. The motor man seems to attach great importance to the dead center of the engine in squaring valves. In these days nearly all the eccentrics are permanently located and keyed to shaft when engine is delivered from the manufactories; or if the engines are built by railroad companies the eccentrics are located and fastened before the wheels are put under the engine, or should be. This can be done easily by measurements; consequently as eccentrics are permanent fixtures, as much so as the main crank pins, it is not necessary to consult the dead center of the engine thereafter to determine any inequalities in the valve gear. The quickest way to square valves is to mark with a tram the lines of the ports on the stems. Be very particular as to this. Put up the blades, fasten with one bolt if they are of slide pattern, then when the engine is fired up and has steam enough to move, start her slowly; as she moves mark the stems when they reach the zero point; one turn in each motion, forward and back, will suffice. See how the marks compare with port marks on stem and be governed accordingly. If there are any inaccuracies all will show at this point; on the other hand, a lim-

ited number only can be determined at the dead center of the engine proper. By the method I have given, it would not take as long as it would to jack up the engine to place the rollers. However, if conditions are such that you would be compelled to wait for engine to be fired up, place your rollers, attach the motor, give the wheels a turn each way. Disregard the dead center and catch the points as I have explained, and in the course of a year you will save the company thousands of dollars. W. W. WALLACE.

Chicago.

Passenger Mogul Engine.

Annexed we illustrate a Mogul passenger engine recently turned out of the Baldwin Locomotive Works for the Quebec & Lake St. John Ry. The cylinders are 14 by 24 by 26 inches, and the driving wheels are 57 inches outside diameter. The boiler is 64 inches diameter at the smallest ring and is made to carry working pressure of 200 pounds to the square inch. There are 1876.4 square feet of heating surface and 31.6 square feet of grate area. The total weight of the engine is 145,230 pounds, of which 120,010 pounds are on the driving wheels.



PASSENGER TRAIN MOGUL.

Cold Drawn Steel Rod Keys.

The method of making rod keys in the C. & N. W. Ry. shops at Chicago, Ill., has in it the element of simplicity and economy. The keys are made of cold drawn steel, which comes in the form of ordinary flat bars. These bars are cut to the proper length by a cold saw and are given the required taper in a Morton draw-cut shaper. The keys having been cut to length are placed side by side upon a smooth inclined plane made of cast iron, and are clamped in place on the machine. The cast iron bed upon which they rest having the proper angle of slope, the action of this shaper, with its powerful draw-cut motion, takes off the metal as a man might cut wood with a spoke shave. After a number of them have thus been properly tapered, a round back is given, when desired, by a few strokes on each separately by the shaper carrying an appropriately formed tool. The operations of cutting and tapering are all that have to be done as the steel bars have the proper thickness, and come to the shop wide enough to just make the top of the key.

Removing a Grease Spot From a Coat

There are two ways of removing a grease spot from a coat, a right way and a wrong way, a scientific method and an unscientific method. In a book published in England called by the simple name of "Soap Bubbles," the scientific way is incidentally set forth. "Soap Bubbles" is really a course of three lectures delivered in the London Institution by C. V. Boys, assistant professor of physics at the Royal College of Science, South Kensington. He performed many very wonderful experiments with soap bubbles before his audience, and in the course of the first lecture explained some of the curious properties which the "skin" of any liquid possesses. The skin referred to is simply the outside very thin film which surrounds a drop of water, a drop of alcohol, a drop of grease or other liquid. All these "skins" hold their drop in globular form with differing degrees of tension. Referring to the difference between the tension of the "skin" of benzine and that of grease, he says:

"If you spill grease on your coat you can take it out very well with benzine. Now if you apply benzine to the grease and then apply fresh benzine to that already there you have this result—there is then greasy benzine on the coat to which you apply fresh benzine. It so happens that greasy benzine has a stronger skin than pure benzine. The greasy benzine, therefore, plays at tug-of-war with pure benzine, and being stronger wins and runs away in all directions, and the more you apply benzine the more the greasy benzine runs away, carrying the grease with it. But if you follow the directions on the bottle, and first make a ring of pure benzine round the grease spot, and then apply benzine to the grease, you then have the greasy benzine running away from the pure benzine ring and heaping itself together in the middle and escaping into the fresh rag that you apply, so that the grease is all of it removed."

Scotch Engines for the Canadian Pacific.

A press dispatch from Montreal says: "The Canadian Pacific Railway has given a contract to the Miller Locomotive Company, of Glasgow, Scotland, for the building of 20 freight locomotives, to be delivered early in 1903. This is an experiment, and if the engines are up to standard in all probability the order will be increased. The contract price, which includes the import duty of 35 per cent. less a third, for preference given by Canada to Great Britain's products, figures out about the same as is quoted in the American market, but as all the works in the United States are congested, it is well nigh impossible to get contracts filled there. It is nearly 20 years since the Canadian Pacific has had any Scotch engines on its system, since which time great improvements have been made in their construction, and it is now claimed they will last longer with fewer repairs than the American article. It is partly to test this, and to add to the motive power that the contract has been awarded."

Enginemen and shopmen all like to be able to talk about valve motions. A man ought to study Link and Valve Motion, by F. A. Halsey. Price, $1. Finely illustrated. Brings a difficult subject within the comprehension of ordinary men and dispels the mystery often made of valve motion.

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The Time Element in Coal Consumption.

It is now pretty generally admitted that coal measured out to an engine by volume, and spoken of as "tons," is by no manner of means equal to what would be dealt out if weighed properly in a balancing hopper. Weighed tons of coal are the only tons, the measured so-called tons may really be above or below their nominal value. The candid admission of this fact has induced many of our leading roads to adopt the weighing, as against the guessing, method of coal handling. Acting on the admission of the fact makes for accuracy.

Experiment has proved that, roughly speaking, it costs twice as much to haul a train at the rate of 60 miles per hour, as it does to pull the same train at 30 miles per hour. Even the most skeptical will probably admit that the cost of producing high speed is greater than that required for the maintenance of a moderate rate of travel, even if they dispute about the figures. In the item of cost, for any speed, the amount of fuel burned practically plays the most important part.

We have, in the science of railroading, come to the point where we deem it essential to know the actual amount of coal burned, and we know that the faster we travel the more coal we will burn, yet in the matter of ton-mile statistics we have not yet made any attempt to connect the time element with the coal consumed. An example will show this.

A and B are two passenger men running sister engines on the same division. As to condition, the engines possess about equal amounts of "scrapheapness," yet are doing good work. The division is 125 miles long and the trains weigh, say, 250 tons. One train runs each way every day, and the schedule time is 3 hours. When everything goes as it should, both engines make 31,250 ton miles in the allotted time, and they burn practically equal amounts of coal, which has been weighed out to them. At the end of the month the amount of coal used is divided by the ton-miles made, and the result is the amount of coal used to make one-ton mile. From that, the cost per ton-mile, as far as coal is concerned, is easily computed.

If A pulls more cars in the month, he makes more ton-miles to divide into his increased coal figures, and his cost per ton-mile may not be greater than that of B, who has gone along steadily in the old way. This is all "plain sailing," because an increase in the coal burned is offset by more ton-miles made.

Suppose now that A and B pull trains of equal weight for a month, but B has been making up time and A has not. B ran over the division, let us say, in 2 hours and 45 minutes, whenever he got the train 15 minutes late. He made the same ton-miles as A did, but he burned more coal to do it, because he was running faster. The company's higher officials may be fairly overjoyed that B makes up time every day or two, but B is in a new position now. His performance will be figured up by a clerk with pen and ink, who shows no emotions of gladness and has not the power to praise or blame. This man finds that A and B made the same number of ton-miles, but B has burned more coal. B has, therefore, apparently cost the company more per ton-mile run than A did, and it is so recorded. B knows it is wrong, so does the man with the pen and ink, if he stops to investigate, but there is no provision made for putting B where he has a perfect right to stand. It was all right to burn more coal when more ton-miles were shown, because both increased together, and thus gave A the chance to keep his average as it should be. When B burned more coal making up time, without increasing his ton-miles, he looked like an expensive man when the searchlight was turned on him.

If B could get his company to consider the time element, he might save his reputation. When everything else is normal 31,250 ton-miles are made in 3 hours, and neglecting fractions, 10,417 ton-miles would be made each hour. But B made the total ton-miles in 2¾ hours, which is at the rate of 11,363 ton-miles per hour, and that is 946 ton-miles per hour more than A. So figured, ton-mileage comes up as coal consumption increases, just as when A pulled heavier trains and burned more coal. If it was fair to keep A's average right, it is only fair to do the same for B. The time element when introduced does not injure either man, if both make the same time with heavy or light trains, but with equal trains the man who makes up time is clearly entitled to have that point considered. In fact, the science of mathematics is not able to give a correct result without it.

Some people may regard all this as a needless complication, and point to the man who guessed at the floor measurements of a box car and assumed its height, and then figured out the cubic contents to five places of decimals, as an example of wasted energy. The cases, however, are not parallel. Whether it be complicated or plain, whether the extra work looks inviting or not, the fact remains that if coal burned represents work done, as it should do, the time element cannot be overlooked in calculations like these, without vitiating the result, and doing an injustice to some one.

Doctoring Coal.

Every few years a patented method of doctoring bituminous coal so as to prevent the emission of smoke is invented. An invention of this sort is receiving a great deal of advertising at present, and we have no doubt many steam users will purchase this remedy, use it for a while, and then drop it, as many before them have done years ago.

We notice in an English paper, mention is made of the Wilson smokeless process, which consists of a minute quantity of nitrate of soda in solution with water, which, when put into the furnace combined with a sufficiency of air, effects complete combustion of the gases. Probably this is true. When the air admitted is just right, there is not likely to be much smoke nuisance.

A variety of compounds have been used in this country for doctoring coal, and they all have consisted largely of oxygen compounds. Of course, the use of such compounds would help a little, but the advocates of the remedies claim far too much for them. A prescription which we have seen says: dissolve one-

half teaspoonful of nitrate of soda in a glass of water and apply the fluid by sprinkling. It would be a remarkably small furnace that this minute application of drugs would affect. The party who is recommending it says:

It reads like a physician's prescription, but it isn't. It is the "directions" for using a patent preparation which, its manufacturers say, will greatly relieve the coal situation, if it does not solve it altogether. It is a patent preparation, it was first prepared and patented by a plumber in Amsterdam avenue last February, and is now being used in several large furnaces in New York, and by many small consumers. Those who have tested it say it does practically all that its manufacturer says it will do.

One difficulty for those on the make about this patent process is that the first patents granted on it expired years ago. The process was offered for sale to New York bankers three years ago and the writer was consulted concerning its utility. He said, find out what your patents are worth. The result of a careful investigation was that the whole thing was dropped.

Raising Wages.

There have been strikes and rumors of strikes during the last month; there have been new consolidations of capital, and corners in necessities of life, but the all-absorbing talk during the month has been raising the pay of railroad men.

When the directors of the Pennsylvania Railroad, at a meeting held last month, determined to increase the wages of their employees 10 per cent., they performed an act which we think, is unparalleled in the history of railroads. The manner in which the increase was given makes it doubly appreciated by the recipients. In urging his directors to grant the increase, President A. J. Cassatt said:

"The country is passing through an unexampled period of prosperity, and as far as the Pennsylvania Railroad is concerned this prosperity is bound to continue for at least two years, if contracts are kept. It is time our employees be given a share of this prosperity. All the railroads in the United States and all the employers of labor are contemplating an advance in wages. The cost of living has increased 20 to 25 per cent., but wages have not increased accordingly.

"This movement is bound to come, and the Pennsylvania may as well lead as follow. We have more business than we can handle, and can't see our way out of that difficulty unless we keep our men loyal to the company and help them while they help us. I therefore recommend a flat increase of 10 per cent. in wages, and advise that the announcement be made to the employees first and to the public later."

As soon as we learned about this action on the part of the Pennsylvania Railroad Company we felt assured that it would have great influence in inducing other companies to do likewise, but we were scarcely prepared for the prompt announcements made by a great many of our largest railroad companies that they also intended raising the pay of their employees. Many railroad employees had commenced to agitate for increase of pay and their reasons for asking more remuneration were nearly the same as those mentioned by Mr. Cassatt as his reasons for advising that the increase be made.

Few of the railroad companies intend to give a flat raise like that accorded by the Pennsylvania. Most of them talk about adjusting inequalities and increasing those whose pay has become inadequate for increase of work that has grown by the progress of the business. Under this head firemen of very large locomotives are slated for an increase of pay, also some station masters and others whose hours of work have been lengthened. Most of the companies, however, expect to advance the pay of their whole working force more or less.

We have heard objections made to our all-round horizontal raise of pay, but we do not perceive any reason why it should not be carried out. When a demand for retrenchment arises the railroad companies do not hesitate to make a horizontal reduction and it is a poor rule that does not work both ways.

Ten days after the announcement of the Pennsylvania Railroad raise of pay, we find that it is having the effect of forcing upward the pay of not only railroad employees, but in nearly all industries. This will have an excellent effect upon the prosperity of the country at large, for increased earnings paid to the huge army of American workmen spreads beneficent seeds of good times throughout the length and breadth of the great country.

Prospect of Better Highways.

The rural, commercial and industrial interests of this country have been so much accustomed to depend upon canals and railroads to transport their products to market, that they have habitually neglected the arteries over which nearly all traffic originates, viz.—the common highway. Farmers and other people living in the country are more interested than other citizens in the construction and maintenance of good highways; yet until a few years ago they displayed obstinate antipathy to help any movement in favor of improving the country's highways. In our great States which are expected to take the lead in all movements for the public good, New York is the most influential; but the legislators of that State have habitually wasted so much money upon the Erie canal that nothing was left for other internal improvements, and public highway interests have been among the worst sufferers. This is particularly unfair to rural interests because the canal promoters agreed to help in securing legislation for the building of a great highway through the State, as a reward to the people in the southern tier of counties for their aid in obtaining subsidies for the canal; yet the promises have not only been ignored, but every obstacle possible has been thrown in the way when any movement has been started to provide the means for carrying out road improvements.

There was nothing for the politician in subsidies for improving highways, but there was no end of boodle in an appropriation for canals, and so the canals have kept the right of way to the public purse. It was nobody's business to push appropriations for highways, and so the roads have been permitted to remain in deplorable condition.

The first systematic movement made to improve the country's highways was originated by bicyclists, when that form of amusement was an active living force. The bicycle fantasy has passed, but it has been succeeded by even a stronger movement, that of automobiling, and the people interested in horseless carriages are agitating strenuously in favor of improved highways, and the influence they exercise as a class promises to produce important results. All they need is the co-operation of farmers and others interested in having good roads to haul their produce over.

The Automobile Club of America have inaugurated a movement which is calculated to effect a revolution in inland transportation if it meets with the support it deserves. A few months ago Gen. Roy Stone, who has made a special study of road making, in an address before the Automobile Club of America, strongly advocated the use of steel plates for making highways. His arguments were so convincing that Mr. Charles M. Schwab, president of the United States Steel Corporation, offered to provide at his own expense steel sufficient to lay a mile of the roadway recommended by Gen. Stone. One block of that steel has been laid in Murray street, New York, a street noted for its heavy traffic, and the indications are that it will fulfil all the promises made for it.

The plates are twelve inches wide and are perfectly flat with the exception of a slight ridge on each side to act as a slight wheel guard; they are laid on cement, are made continuous by riveted joints and are set 4 feet 6 inches from center to center.

The remainder of the mile will be laid in different places near New York, where they can be readily examined by people interested in highways of this character.

Gen. Stone says that this style of roadway can be laid down for about $4,000 a mile. The work has been done by the influence of automobile interests, but it will probably be found of greater value to other users of public highways.

Every person familiar with teaming in cities is aware of the great reduction of wheel resistance that results from the wheels of a wagon being run on the plates attached to street car rails. If the day ever comes that the country roads are laid with steel runways, the saving to people who have to haul freight over the roads will be immense. Experiments made by engineers of high reputation have shown that a horse can haul on an iron or steel track 54 times the load it can haul in sand, 33 times as much on a stone trackway, 25 times as much on a plank road in good order, 9 times as much on a good macadamized road and thirty-six times as much on a bad earth road. Most of the roads that farmers have to haul their produce over are earth roads, so the change to steel would increase the haulage thirty-six times in the majority of cases. The introduction of such an improvement ought to draw the cordial co-operation of every person who wishes to see our agricultural communities prospering.

Tonnage Rating by Drawbar Pull.

There are three methods of rating engines in vogue at the present time, as pointed out by Mr. H. A. Fergusson, assistant superintendent of motive power of the C. G. W. Ry., at a recent meeting of the Northwest Railway Club. These methods are the "straight" tonnage plan, which makes up the same tonnage every time for the same engine regardless of the number of cars in which the load is distributed, with perhaps an arbitrary allowance for empties. The "adjusted tonnage" system by which a fixed average factor is added to each car regardless of weight, and lastly the rating which is determined by draw-bar pull.

Mr. Fergusson pointed out that he had observed in dynamometer tests that an empty steel car weighing 40,000 pounds required a draw-bar pull of 5.86 pounds per ton to move it, and that a wooden hopper car, weighing 26,000 pounds, loaded up to a gross weight of 40,000 pounds, required a draw-bar pull of 5.82 pounds to move it (that is a difference of a little over half an ounce), so that the gross load on four axles being the same, the draw-bar pull is practically identical in each case without reference to what proportion is dead weight, and what is paying load.

Two curves had been plotted, he said, from figures extending over six month's work with a dynamometer car, one curve showing the pounds per ton draw-bar pull, in which the now well-known fact is clearly brought out, that the required pounds per ton pull for a heavy car is much less than the pounds per ton pull of a light car. The other curve was plotted by multiplying pounds per ton by the weight of the car. Deductions from this latter curve pointed to the importance of taking care of the resistance of each car separately. The curves are of course for straight and level track.

The figures represented graphically by the curves were tabulated after the following operation had been performed, which is intended to allow for the ruling grade and the curves on the division. The total draw-bar pull for a definite weight of train is found by dynamometer test. The draw-bar pull is then divided by the number of cars in the train, which gives the average draw-bar pull in pounds per car; the weight of train divided by the number of cars in it gives the average weight of a car. Then having the draw-bar pull per car, and the average weight of each car, the draw-bar pull per ton for that particular weight of car is easily arrived at. Having got this figure, it now is only necessary to look to the graphic representation of the draw-bar pull, and subtracting the figure for level, straight track from the one just found for the ruling grade and curve, the remainder is the one which represents the resistance due to that curve and that grade, and this figure is constant for any weight of car.

This constant, plus the plotted curve figure for pull on level, straight track, is then tabulated as draw-bar pull for each gross weight of car for the particular division in question. In this method of tonnage rating the rule is simply, add the pounds draw-bar pull corresponding to each weight of car, until the total equals the engine rating. This method consists in loading an engine of known draw-bar pull by adding up car resistances, expressed in terms of that draw-bar pull.

Another Rotary Engine Coming to Revolutionize Things.

We are again threatened with the rotary locomotive. A recent dispatch from Plainfield, N. J., says that a mechanic in that city "has invented a rotary engine expected to revolutionize motive power. It is called a positive expansion reversible rotary engine. A model in his shop attains from 1,000 to 5,000 revolutions a minute, and is instantly reversible without shock or jar. With this engine he asserts that a railroad train will move at the rate of 200 miles an hour."

There have been few months in the last 50 years that have not given birth to a rotary engine and they are all going to revolutionize motive power. That motive power has stood a vast amount of revolutionizing without making a perceptible move.

Street Car System Under Municipal Management.

There is an impression in this country that city councils cannot manage public works, such as street railways, to advantage, but the councils of several British cities have demonstrated that they can carry on the business better than private companies. Glasgow is a shining example of this. Some eight years ago the leases of the street railways expired and the city council took possession of them. Since that time they have not only reduced the fares radically, but they have made sufficient profits from the operation of the lines to make material reduction in taxes. The following are a few extracts from a recent report:

There was a gross surplus of £209,310 as the result of the past year's working of the Glasgow Corporation Tramways, the receipts being £614,413, and the expenditures £405,103. The revenue of the previous year, before the complete installation of electric traction, amounted to £489,469, the balance being £87,629.

The last of the horse cars were withdrawn on April 14. From the beginning of the year to that date the receipts of the horse cars amounted to £30,680. The transition from one system of haulage to the other involved the sale of 4,060 horses, the department retaining only 87 animals for its requirements.

During the seven years of horse haulage the stud was maintained out of revenue, and, in addition, depreciation was written off at the rate of £2 per horse per annum, and at May 31, 1901, the stud stood in the books at £18 per horse. This was in view of the change of traction. The result shows that this policy was justified, there being a net profit on the sales of £1,042, which has been carried to the general reserve fund.

The financial results of electric traction as compared with horse traction, the committee say in their report, have so far been entirely satisfactory. Although the car mileage has been very much increased the average revenue per mile has been maintained. Before next winter nearly all the authorized extensions will be in operation. The success which has attended the work of the department during the past eight years has enabled the committee, out of revenue, to renew the whole of the track and to write down the disused horse traction plant to scrap value.

Through setting aside ample sums for depreciation and by building up the renewal and reserve funds, they have been enabled to start the new system of traction almost entirely unburdened by any expenditure connected with the old. The committee express high appreciation of the manner in which the change from horse to electric traction has been carried out by the general manager and his staff.

A Lesson from the Indicator.

We find that a great many of the younger portion of our readers are very much interested in the steam engine indicator, but it seems very difficult for them to see what it points out as being wrong with the distribution of steam in the cylinders. One of the best illustrations of what the indicator diagram can point out as being wrong is shown in our correspondence columns in the contribution from Mr. S. J. Dillon. The diagrams are taken from a stationary engine, but their teaching is just as applicable to the student as if they were taken from a locomotive.

We are sorry to say that most of the indicator diagrams which are sent to this office, as having been taken from locomotives, are as nearly perfect as steam distribution will allow. People interested in a particular locomotive become proud of the way the work is done, apply the indicator and obtain diagrams notable only for showing good steam distribution. What we have always insisted on is that the locomotive to apply the steam engine indicator to is one which is working very badly. There are many of them at work which distribute the steam as badly as the engine which Mr. Dillon indicated before adjustment was made, and adjustment is just as badly needed in such cases as it was in the engine whose diagrams are illustrated. That, however, is foreign to the question at hand, which is that our student readers ought to study the diagrams and descriptions of those shown in our correspondence columns.

BOOK REVIEWS.

"Worm and Spiral Gearing." By F. A. Halsey. New York: D. Van Nostrand & Co. 1902. Price, 50 cents.

This book of 85 pages is practically a reprint of articles which have appeared from time to time in the pages of the *American Machinist*, of which Mr. Halsey is an associate editor. The theory of worm gearing is taken up and handled clearly and fully. Graphic and analytical methods for the design of worm and spiral gearing are given. Spiral gearing is discussed at length. It very often happens, as is pointed out by the author, that it is not so much the geometrical nature of the problems to be solved in this kind of work, which hampers its successful accomplishment, as it is the lack of facilities in the workshop. The information contained in this neat little work will no doubt be of great value to designers, as the whole subject is not any too well understood. One feature in the make-up of the book itself is deserving of mention. It is the fact that all the illustrations are printed on pages wider than those containing the text, and these wider pages fold up among the others when not in use. The reader, when using the book, has the advantage of being able to keep the figure referred to before him as he turns over the pages of reading matter without having to constantly refer back to diagrams and letters, as is usually the case. The book contains 23 of these engravings and an index.

"The Slide Valve and Its Functions." By Julius Begtrup, M.E., New York: D. Van Nostrand Company. London: E. & F. N. Spon, Ltd. 1902. Price, $2.00.

This work is divided into six chapters dealing respectively with the common slide valve, improved slide valves, four-valve systems, independent cutoff, the slide valve on pumps, and the angularity of connecting rod and eccentric rod. The principles upon which the slide valve operate are very carefully stated and analyzed. A large number of special valves are described, among which may be mentioned the Westinghouse compound valve, the Vauclain valve, and the Corliss system. Graphic methods are used in the elucidation of the subject. The book is free from technical details and the author handles his subject simply and directly. There are 143 pages, measuring about 6 by 9 inches, with 87 illustrations, and a comprehensive index is appended. Altogether the work should be valuable to the student of valve gear as well as to the designing engineer.

"A Manual of Drawing." By C. E. Coolidge, Asst. Prof. of Machine Design, Sibley College, Cornell University. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 1902. Price, $1.00.

The author tells us in the preface that the object of this work is to put into permanent form a single and standard drafting room system which will tend to alleviate unnecessary burdens thrust upon the student. The book is therefore one for the student rather than for the full-fledged and experienced draughtsman. It is so bound that the printed matter appears only upon the left hand page, the opposite one being left blank so that the instructor may cause the student to note down such matter as may be of value.

The book is divided into two parts, the first deals with materials and measurements, and the second with commercial, mechanical drawings. On the margin of each page is a "heading" which indicates the subject matter of each paragraph and the comprehensive index which is appended gives a means for ready reference. Ten pages at the back of the book are devoted to examples of ordinary commercial drawings, with samples of letters and the conventional methods of showing various materials in section, such as cast iron, steel, wood, rubber, concrete, etc. All these drawings are numbered and reference is made to them in the body of the text.

The work contains much useful information which will help the student to readily conform to the conventional methods of representing various objects and also assist him in reading drawings. The work is practical and up to date.

QUESTIONS ANSWERED.

(169) Several correspondents ask, on what grounds do you make the assertion on page 437 of your October number that a flash boiler would be impracticable for a locomotive? A.—There are forces and appliances adapted to small powers that are impracticable for large ones. It seems to us that applying a flash boiler to a locomotive is a case in point. If a flash boiler capable of generating the great volume of steam needed by a locomotive were practicable, the carrying of several tons of gasoline on a train would not be tolerated.

(170) C. D. G., Cherokee, Ia., writes:

We have two passenger engines here that ride smooth until they get up to a speed of 30 miles per hour; then they begin to kick and jerk enough to make a man wonder how they can possibly hold together; they keep this up until they get to a speed of 50 miles per hour, then they run smooth again; they ride nice when the throttle is closed and engine at any speed, but when we first shut off, and before reverse lever is dropped ahead (like coming into a station at full speed), you would think the rims had fallen from off the drivers, and the wheels were running on the ends of the spokes. These engines have been put in tram and side rods adjusted, and still they are the same. The valves are set line and line in full gear, and when they are cutting off at seven inches they have a scant 1-4 inch lead. Can you tell me why these engines are such rough riders? I forgot to say that the link saddles are not like the saddles on the other engines, but are long vertically; and the suspension stud is three inches above the center of the link. Please write and let me know how to remedy this rough riding. A.—We incline to think that the rough riding of these engines is caused by excessive steam compression and that they are a good subject for the indicator.

(171) A. S., New York, writes:

Would you kindly tell me if all soft coal locomotives can with equal success burn hard coal and whether all hard-coal engines can equally as well burn soft coal? A.—Fire-boxes are generally designed specially for the kind of coal to be used. Hard coal fire-boxes can be made to burn soft coal, but fire-boxes

made for soft coal have generally too little grate area to burn hard coal successfully.

Let me know the kind of coal the New York Central burn on their new automatic type engines? A.—Soft coal.

(172) L. A. R., Chicago, writes:

Can you tell me where I can find the standard rules made for the regulation of train movement on the different railroads in the United States and Canada? A.—There is only one standard code of train rules, and that has been issued by the American Railway Association, which consists of the leading railroad officials in the United States. There is likelihood of a law being passed to make the use of the standard rules compulsory on all railroads engaged in Interstate Commerce.

(173) R. M. Y. writes:

I belong to a club of young mechanics who help each other in the study of subjects relating to our business. We have lately been discussing the subjects of force and power. We appear to be mixed about the meaning of these words, and decided to ask you for a definition. A.—Force is the cause of all physical phenomena, including mechanical forces that are measurable; also heat, light, electricity and chemical action. Power is a form of energy capable of producing change of state or of performing work.

(174) B. R. O., New York city, asks:

Which is the best kind of a driver brake, one which has a horizontal pull or one which pulls straight up and down? A.—A push brake is better than a pull, as the stuffing box is done away with. The brake which pushes down in a perpendicular direction is much preferable to the horizontal type, for the reason that the wear of the packing leather is even on all sides, and does not bear on the bottom merely and wears out that portion of the leather, as does the horizontal type.

(175) M. M. D., Albany, N. Y., asks:

Will we get any better signal on the engine by holding onto the bell cord in the car and keeping the discharge valve open a long time? A.—No better, nor as good a signal, will be had as if a short, sharp, quick pull of the cord is made, thereby venting pressure at the discharge valve sharply and quickly. Again, the longer pull of the cord will interfere with the succeeding signal.

Private Car Owners Worst the Railroads.

An unusually vigorous effort has been made lately by leading railroads to lighten themselves from the burden of hauling private line cars. Movements of this kind have been made repeatedly always to end in failure, but the railroad companies will eventually win if the good work is kept up. A recent Associated Press dispatch from Chicago says:

General surprise was caused in railway circles yesterday by the announcement that the Southern Pacific Road had renewed its three-year contract for the use of Armour & Co.'s refrigerator cars in the California fruit traffic.

It was also stated that the Santa Fe had persisted in its refusal to renew the contract with the Armour company and will insist upon using its own cars, over 4,000 having been built by the company during the last two years.

The attitude of the two railroad companies in the matter is of considerable interest, especially in view of the war which J. W. Midgley is making against the owners of private cars. About six months ago both the Southern Pacific and the Santa Fe gave notice to the Armours that when the present contracts expired they would not be renewed. The companies worked diligently to get new quipment so as to be in shape to take care of the California fruit crop without the assistance of the Armour cars, and so far as can be learned both succeeded.

Some threats of retaliation on the part of the Armour people brought the railroad companies to terms.

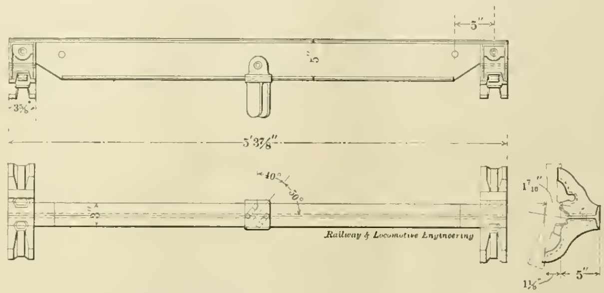
Popular Liking for High Speed.

The agitation which arises every few years in favor of having trains make the run between New York and Chicago at a speed of sixty miles an hour is the expression of a sentiment as old as human life, the desire to annihilate distance or to reduce the time needed in going from place to place to the lowest possible limits. All animals with well-developed powers of locomotion are natural racers, and man takes the lead; but being beaten in fleetness by certain animals he has worked steadily and intelligently to develop the speed of the horse, which is the fleetest animal that runs.

The horse can be made to run wonderfully fast for a short distance, but the pace cannot be maintained long enough to satisfy people who have acquired a taste for rapid speed, and so the indications are that the horse as a roadster will be gradually pushed out of use by mechanical traction. There is a strong racing element in the blood of the people of nearly all nations. They strive to shorten the time of travel between given points, but more than that, they delight in rapid motion. Many people will wait and lose an hour to go with a fast train. They cannot explain why they do this, but it is just their enjoyment of rapid motion. Express trains, steamboats, yachts, horses and automobiles must all be fast to be popular. There is no use fighting against this taste for speed, because it is in the blood.

New Metal Brake Beam.

A very simple but durable brake beam, designed by Cornelius Vanderbilt, M. E., and handled by the Buffalo Brake Beam Company, of 100 Broadway, New York, has been lately been put in active railway service. It consists of a 5 in. I-beam, with 3 in. flanges top and bottom. The beam is used on tender trucks and cars, and is intended for inside hung brakes. At each end the web of the I-beam is cut back so as to gain space for the brake head and shoe. This cutting does not materially weaken the beam, and in addition to the accommodation of head and shoe in confined space, it is possible to cut off the heads of the fulcrum rivets, back them out, and slide the fulcrums off the beam and apply others, when necessary, without taking off the brake heads. This special form of beam has been patented.



VANDERBILT STEEL BRAKE BEAM.

As was mentioned in a previous issue, the *Locomotive Magazine*, of London, hitherto a monthly, will, on the first of the year, appear weekly. The magazine is under such admirable management that we feel certain that the weekly will be as popular as the monthly has been. This office will receive subscriptions for the *Locomotive Magazine*, the yearly price being $2.25, or $4.00 a year for the *Magazine* and RAILWAY AND LOCOMOTIVE ENGINEERING.

Let us take care how we laugh without reason lest we cry with it.—*Martin Chuzzlewit.*

Atlantic Type Express Engine for the Big Four.

The Cleveland, Cincinnati, Chicago & St. Louis Railway Company, commonly called the Big Four, have recently received some engines from the American Locomotive Company, which are intended for heavy fast passenger service. These simple, 4-4-2 machines were built at the Brooks Works, and possess several interesting features. The cylinders are 20 1-2 x 26 in., the drivers are 78 in. in diameter, and 100,000 pounds rest upon them. The total weight of the engine itself is 186,000 pounds. The diameter of the boiler at the first ring is 70 1-8 in. and the tender capacity is 10 tons of coal and 6,000 gallons of water.

A feature of the design which at once strikes the eye, is the modified Davis counterbalance in the driving wheels. We say modified, because the original Davis counterpoise was made in the form of two flat discs, which touched the rim, as a matter of course, each only at one point. The form adopted for this engine, while retaining the essential idea of the inventor, yet allows the use of less actual weight in the counterbalances, as they touch the rim all along their length. In years gone by, it was not unusual to see an 8-wheel engine counterbalanced by a pair of weights bolted between the spokes, the trailing wheel having one such weight, and the driving wheel having two, placed so as to have the space between two spokes employed in separating the weights; thus approximating in form to this system.

The valves are of the piston type, and the motion is direct. The crossheads are of the two-guide-bar type, keyed to the piston rod. The upper guide has a projecting rib running centrally along its under side, which engages with a corresponding groove in the upper side of the crosshead. This does away with the usual lipping-up of the crosshead around the top bar, and thus removes a dust and grit collecting opening, which was inherent in the older design. As it is now, guide and crosshead work together flush on top, and the lip of the latter, over the lower guide, not having any tendency to collect dirt, conforms to usual practice.

The spring-hangers on the carrying wheel springs are of cast steel, hook shaped in section, with side plates. These grip the ends of the springs, as a man might grip a bar above his head with his fingers, but without using his thumbs. The hangers on the other springs are U-shaped steel castings, which pass up the sides and over the top of the spring-ends having each a transverse rib which takes the place of the gib usually employed, and fitting into a corresponding depression in the spring. All these hangers have the property of giving free motion, without the spring-ends being cut or slotted in any way.

The ash pan is hopper-shaped and is self-dumping; the Player ash-pan doors are used. The boiler, which carries 200 pounds pressure, tapers gradually toward the front end. The carrying truck presents a neat appearance, as the axle-box is inside the frame, and the wheels are 51 in. in diameter The truck is radial, and has a spring self-centering device, which allows for easy adjustment on curves, and positive return on tangents. The proportioning of the whole machine is good, and its appearance is pleasing. The tractive effort is about 23,800 pounds.

Some of principal dimensions are as follows:

GENERAL DIMENSIONS.

Weight in working order, 186,000 lbs.
Weight on drivers, 100,000 lbs.
Weight engine and tender in working order, 310,000 lbs. Wheel base, engine, 28 ft. 5 in.
Wheel base, total, engine and tender, 55 ft. 3⅞ in.

CYLINDERS.

Size, 20½ x 26 ins. Size of steam ports, 1⅞ x 25/8 in.
Size of exhaust ports, 65 in. Size of bridges, 3 in.

VALVES.

Kind, piston. Outside lap, 1⅛ in
Lead in full gear, 1/16 in.

WHEELS, ETC.

Dia. of driving wheels outside of tire, 78 in.
Mat'l of driving wheels, centers, cast steel.
Tire held by shrinkage and retaining rings.
Dia. and length of driving journals, 9¼ x 12 in.
Dia. and lgth. of main crank pin jrnls., 6½ x 7 in.
Dia. and lgth. of side rod crank pin jrnls., 7 x 4¼ in.

BOILER.

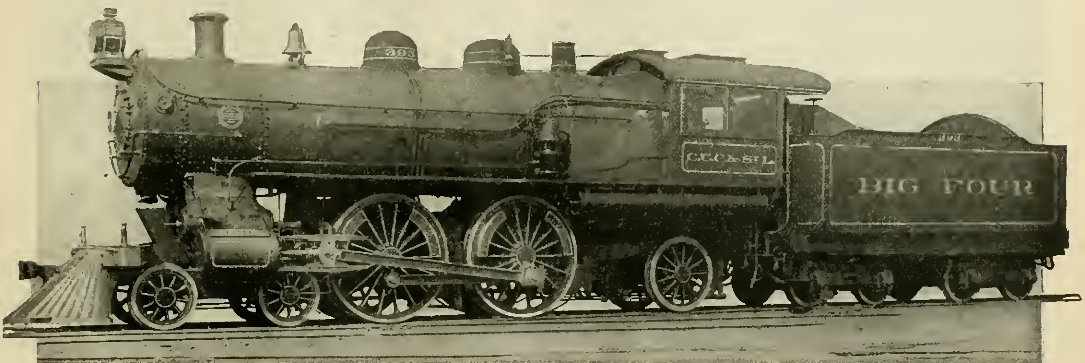
Style, radial stayed, wagon top.
Outside dia. of first rings, 70⅛ in.
Working pressure, 200 lbs. Fire box, length, 97 in., width, 76 in.; depth, front, 78½ in.; back, 69½ in.
Fire box plates, thickness, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube sheet, ⅝ in. Fire box, water space, front, 4 in.; sides, 3½ in.; back, 3½ in.
Tubes, gauge, No. 11, B. W. G.; number, 380; dia.; 2 in.; length over tube sheets, 16 ft. ⅛ in.

Heating surface, tubes	3,164.96	sq ft.
Heating surface, fire box	175.1	sq. ft.
Total	3,340	sq. ft

Grate surface, 51.66 sq. ft.

TENDER.

Weight, empty, 49,320 lbs. Wheel base, 18 ft.
Tender frame, steel channel.
Tender trucks, Fox pressed steel.
Water capacity, 6,000 U. S. gals. Coal, 10 tons.
Brake, Westinghouse high speed automatic brake for tender and train service, 9½ in. pump, outside equalized brake on drivers and trailing wheels.



ATLANTIC TYPE ENGINE FOR BIG FOUR ROAD

Private Railway Station.

Lord Barrymore is the only individual in the south of Ireland who possesses the luxury of a private railway station. The line between Cork and Queenstown runs directly through the most beautiful part of Lord Barrymore's lovely demesne at Fota, and, of course, somewhat disfigures the beauty of the place. By way of compensation, the railway company built a railway station at Fota. No one can stop at this station without a written permit from Lord Barrymore or his agent—a concession readily obtained by those who wish to visit the beautiful place when the owner is away from home.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Brake Beam Springs.

The problem of brake beam springs for air-braked cars has assumed unusual prominence. Many of the cars now built are equipped with beam springs so very stiff that they absorb from 30 to 50 per cent. of the brake force which is sent to the wheels, thereby reducing valuable brake power. Thus we see going forward a contest similar to that of naval and fort armament wherein one side is endeavoring to lead and keep ahead of the other—the armor plate for the ships being gradually thickened and the guns to pierce this armor being proportionately made heavier and more powerful. In a like manner we find the brake beam springs on cars growing stronger and stiffer and the brake cylinders being put on by the brake company becoming larger in order to overcome the resistance of the springs. It is simply a case of wasted energy. The light, innocent-looking brake beam spring of a few years ago, intended to keep the brake shoes from rubbing the wheels, due to faulty brake beam hanging, has grown into a formidable resistance and absorber of brake power.

A correspondent writes us of an experience of his where he found a brake beam spring to be so stiff that he was obliged to run a chain around the brake beam and the axle in order to draw the brake shoes up to the wheels close enough to place a dead lever pin in its hole. A similar case was observed by us a short time ago where we noted a repairman employing a powerful tool for overcoming the resistance of brake beam springs and which interfered with his taking up slack on the dead lever. The tool consisted of a hook run around the axle, and at the opposite end was a screw with a crank nut. These were used to compress the springs.

Numerous experiments have proved the brake beam springs to be really a detriment from an air-brake standpoint, and designs have been made by which the beams are given an angularity in hanging so that they drop away from wheels when brakes are released. This seems a much more successful way of holding brake shoes away from the wheels. Of course such a method sometimes requires a longer truck frame than is had on some of the older cars; but this point is worth observing in the building of new cars and the installation of air brakes on them.

One of the best solutions of the problem is to equip with inside-hung beams, giving the hanger the proper angularity to permit the shoes to drop away from the wheels.

Fig. I—TEXAS & PACIFIC RY. AND INTERNATIONAL & GREAT NORTHERN R. R. AIR-BRAKE INSTRUCTION CAR.

Water in Train Pipes.

One of the most prominent subjects before railroads to-day in the maintenance of air brakes is the presence of water in train pipes which collects there and freezes, giving trouble.

The fact that committees from the Master Car Builders' Association, the Air-Brake Association, the Traveling Engineers' Association and all the air-brake clubs, are now investigating this problem, proves the importance of the subject.

The main point to be now determined seems to be the proper length of piping between the air pump and the main reservoir. Too short a length of piping, so the Air-Brake Association has discovered, will permit the pump to deliver hot air to the main reservoir, from where it passes back, still hot, into the train pipe, where it cools and deposits its moisture. Too long a discharge pipe will permit a freezing at the connection of the discharge pipe at the main reservoir. The length of pipe, therefore, seems to be the all-important point to decide at the present time.

CORRESPONDENCE.

Texas Pacific Air-Brake Instruction Car.

I send you herewith some photographs of our air-brake instruction car. They are not as good as I would wish, but they are the best our Texas photographer could make.

The total length of the car body is 46 feet, the class room is 34 feet 6 inches long, which gives ample room to a class of ten men, although twelve can be accommodated without crowding.

The brake rack, as will be seen on the photograph, is arranged at one side of the car, and the weight is balanced by a water tank under the car on the opposite side.

The boiler is 36 inches in diameter by 6 feet 8 inches high, submerged chamber type, with 85 2-inch flues, and is located over the center of the truck. The coal bin is located in the corner as usual. The boiler is supplied with feed water by a Worthington 2 x 2 x 3-inch duplex pump and a No. 15 Hancock inspirator. The main reservoirs are located under the car so that the full benefit of drainage and cooling effects may be had, as well as gaining the room usually taken up by these reservoirs when they are located inside of the car.

The office end of the car is provided with all the convenient appurtenances desirable, such as lockers, book case, desk, lavatory and a double upper and lower Pullman berth. The total weight of the car is 64,000 pounds. The boiler end weighs 35,000 and the office end 29,000 pounds, carried on two four-wheel trucks.

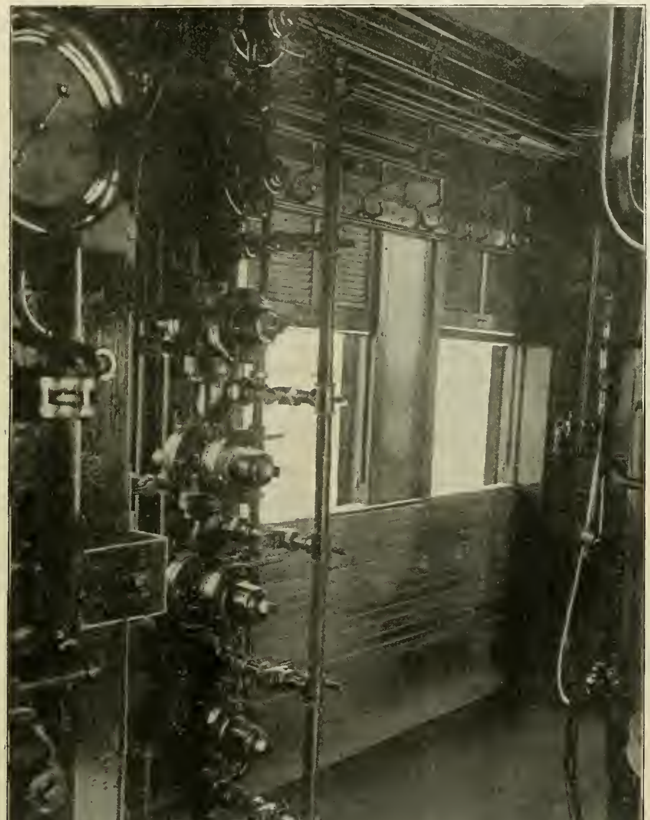


Fig. 2—TEXAS PACIFIC RY. AND INTERNATIONAL & GREAT NORTHERN R. R. INSTRUCTION CAR. DEFECTIVE TRIPLE VALVE RACK.

Fig. 1 is a view looking down the aisle. Note the arrangement of gages on the cylinders and reservoirs, also adjusting devices for piston travel on cylinders.

Fig. 2 shows the defective triple valve rack where six "bad orders" are connected to one cylinder and reservoir.

Fig. 3 is a view looking toward the office. On the left-hand side is a case containing Westinghouse instruction charts, eighteen mounted on special Hartshorn rollers, also eyesight and color testing arrangement. The right-hand side of the door shows engineer's brake valve and air and recording gages, also an arrangement of gages on brake and auxiliary reservoirs at edge of the picture.

Fig. 4 is an exterior view of the car and shows the location of the main reservoirs under the car.

We have tried to make this an air-brake instruction car, and have purposely omitted all the sectional injectors, lubricators, etc., which so often take up space that could be used to better advantage for air-brake apparatus.

As an inspiration to our scholars, we have had painted over the door leading to the office the slogan of the Air-Brake Association—"To Obtain a Higher Efficiency in Air-Brake Service."

H. A. Wahlert,
Gen'l A.-B. Inspr. T. & P. Ry. and I. & G. N. R. R.
Marshall, Tex.

Emergency Tests of Air Brakes.

After reading Mr. Best's criticism in the November issue on my article relating to "Emergency Tests of Air Brakes" in the October issue, I feel that I should reply. The first point he makes is that it is possible for a stop-cock to work shut, or partly shut, on the road, but admits that this is not very likely to occur. The proposed test is not for the purpose of proving that an angle-cock will not work partly closed on the road, any more than the service test is for the purpose of proving that one will not work entirely closed. It will simply prove, what it is intended to prove, that the train pipe is wide open, the same as the service application test proves that there is open communication from engine to rear car, and neither can prove that it will remain in the condition it is in at time of test, and yet no one doubts the advisability of a service test.

Second point. He says "The foundation brake gear is plenty strong enough for usual service operations of the brake and for an occasional emergency application, but I doubt very much if it is strong enough to stand very long the continual strain of emergency test of the brake at terminals, such as Mr. Desoe advocates." Quoting from the Westinghouse Air Brake Co.'s bulletin No. 10. "It is therefore only necessary to add this pressure-reducing valve to the quick-action brake apparatus, already in use upon any passenger car provided with standard brake gear, to convert the apparatus into the High Speed Brake." The High Speed Brake, as is well known, increases the stress on the foundation brake about 30 per cent., and yet it is considered strong enough to stand it with safety. If there are any cars

equipped with a foundation brake which has not sufficient strength to permit an emergency application without danger of its giving out, is it not much better to find it out at the terminal than on the road at a time when the loss of retardation on one car may permit the train to run a sufficient farther distance, than it would have otherwise doné, to result in the loss of lives and great damage to property?

Fig 3—TEXAS & PACIFIC RAILWAY AND INTERNATIONAL & GREAT NORTHERN R. R. AIR-BRAKE INSTRUCTION CAR—VIEW SHOWING BRAKE VALVE AND GAGES.

Certainly this is not a valid objection to the test referred to, and in my opinion is in favor of it.

Third point. This is where he attempts to prove the inadvisability of the test by a statement to the effect that it is not necessary for the angle-cocks to be wide open in order to obtain quick-action. I think in regard to this point, Mr. Best will agree with me that the length of the train, and, therefore, the volume of train-line pressure, determines to a large extent the area of opening necessary. It being the speed of reduction, rather than the amount of reduction, which accomplishes this operation of the brake. This may be illustrated by closing both angle-cocks on the head car of a 50-car freight train, and then, with hose uncoupled at head end, make an emergency application by opening the angle-cock on that end no more than necessary to cause quick action, and note the position of the handle. Now connect hose and open all angle-cocks and charge train, and then again uncouple the hose, after closing the angle-cock on head end of first car; now open it no more than necessary to obtain a quick-action application on the entire train and then note how much more it is necessary to open it with 50 cars than with only one. This, I believe, will demonstrate that with long trains it is necessary that they should be wide open to insure quick-action application. And it is not on long heavy passenger or freight trains that quick-action, so far as a serial application is concerned, is of the most benefit.

Mr. Best winds up his statement about it not being necessary for angle-cocks to be wide open by saying: "But of course, all cocks should be wide open, but would not the better plan be to take additional pains when making up the train and see that the cocks are open, instead of carelessly making up the train and then making an emergency application to prove that all cocks are open." Certainly inspectors and trainmen should be instructed to fully open all angle-cocks, and if one is not fully open it could not be said that they

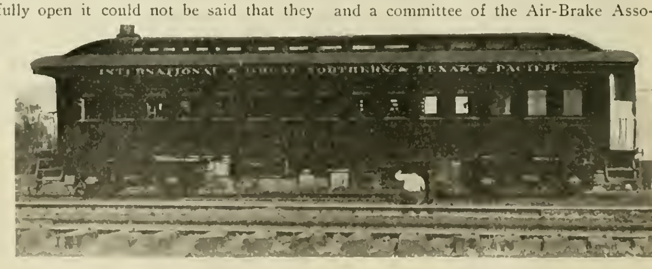


Fig. 4 EXTERIOR VIEW OF THE TEXAS & PACIFIC AND INTERNATIONAL & GREAT NORTHERN R. R. AIR BRAKE INSTRUCTION CAR.

forgot to so open it, if they open it at all, but they can easily be deceived in what they have done by its turning a little hard, or by the lip of the handle striking the body of the valve instead of the stop for this purpose. Again the lip may be broken off and in this case may be moved by, to a position where it is not wide open, or the handle itself may come in contact with some part of the car which will prevent it from being moved as far as it should be. Being deceived is worse than forgetting, for good reliable men who would not forget to open an angle-cock may be deceived in its being wide open.

Then again the angle-cock is not the only obstruction which will prevent quick-action. Any obstruction which will prevent the free flow of air through the train pipe will do it. My attention was called to a car last week on which the train pipe would not permit a sufficiently rapid flow of air to give quick-action, and on investigation it was found partly filled with scale.

Where as the principal object of a test of this kind is to prove that the train pipe is not obstructed so as to prevent a quick-action application of the brake the entire length of the train, it will also prove that there are not too many cars together on which the brake is cut out, or too many pipe cars together, or too many together with the emergency feature inoperative. If the emergency parts are so weak that they cannot be operated to prove that they are in working order without great risk of their giving out, as Mr. Best claims, then can they be depended on not to give out when the brake is most needed.

E. G. Desoe,
General Air-Brake Inspector, B. & A. R. R.
Springfield, Mass.

Drivers Sliding with Engine Reversed.

After reading the article in November issue of the Railway and Locomotive Engineering on the subject of Drivers Sliding with Engine Reversed, by Albert N. Jones, of the Southern Railway, Atlanta, Ga., would say for the benefit of Mr. Jones and readers of your valuable paper that in 1895 the Nashville, Chattanooga & St. Louis Railway, the road I represent, and a committee of the Air-Brake Association made some very extensive tests to demonstrate the relative length of stop which can be made with air brakes and engine reversed; also how much further the engine will run if reversed when air brakes are applied and the wheels locked than if the air brakes alone be used.

It was clearly demonstrated that the

length of the stop made with air brakes applied and engine reversed, while being longer and extremely injurious to the tire from skidding and making flat spots, was not quite as long as was expected, but is satisfactorily accounted for by the fact that as the flat spot grew during the stop, and with the heat developed, gave a larger and better surface to the rail for adhesion. The stop was longer than those made with the brakes alone, and the flat spots made the stop very costly.

At a speed of 30 miles per hour with a light engine, driver and tender brakes applied and engine reversed, no sand, average stop was made in 276 feet. Time required to make stop, 12 seconds; driving wheels slid, flat spots, 2 1-8 inches.

At 30 miles per hour, with driver and tender brakes applied, no sand, average stop was made in 254 feet. Time for making stop, 11 seconds; no wheels slid, or flat spots. It will be readily seen that the stop made with engine reversed was 22 feet longer than the one made with brakes alone, and very costly.

At 40 miles per hour, driver and tender brakes applied, no sand, average stop was made in 475 feet; total time in making stop, 25 seconds; no wheels slid, no flat spots.

At 40 miles per hour, engine reversed, sand used, average stop was made in 542 feet; 23 seconds total time required to make stop. Wheels slid. Flat spots, 4 inches. In the latter case it will also be seen that the stop with engine reversed was 67 feet longer than the one made with brakes alone.

In making the stops herein mentioned, brakes were applied and engine reversed as quickly as could possibly be done. Drivers would invariably lock almost the moment engine was reversed. Applying sand to the rail did not unlock the drivers.

It was also clearly demonstrated that in making the unexpected emergency stops, which, of course, are required as Mr. Jones describes in his article, that if he discovered a rock or something on the track ahead, it would be folly to reverse the engine, as the length of stop would be increased. Yours truly,

OTTO BEST,
A.-B. Inspr. N. C. & St. L. Ry.
Nashville, Tenn.

Air-Brake News from Australia.

In connection with air-brake news, I am glad to announce that we have at last an air-brake instructor, but he is heavily handicapped by having no instruction car. There are classes held and examinations gone through which may count for something, but I maintain that an ounce of practical showing is worth a ton of theory with air brake workings. The drivers and firemen are now agitating for an instruction car which the department says costs money.

Up to the present the men have not received any training whatever, except what they have learned in actual practice, and I must say that from accounts which are published in ENGINEERING, of the number of instruction cars and brake inspectors on American railroads, our men can more than hold their own in the working of air brakes, judging from the accidents occurring and breakaways in the States. This will be better understood when I state that our goods trains are made up to 50 vehicles (four-wheeled and bogie), with loose coupling, and on level roads I have known as many as 96 vehicles being on one train. So you can imagine the amount of slack coupling there must be on trains of this description. Still breakaways are an exception in our working.

A. PERCIVAL.
Newtown, Australia.

The St. Louis Air-Brake Club.

A number of air-brake inspectors, employed on lines entering St. Louis, says the St. Louis *Globe-Democrat*, met at the office of the American Brake Co., October 10, and organized the St. Louis Air-Brake Club. Mr. Chas. F. Smith, traveling engineer and air brake inspector of the St. Louis Terminal Railway, was elected president, and Mr. C. P. Cass, of the Westinghouse Air-Brake Co., secretary. The object of the club is to meet monthly on the morning of the St. Louis Railway Club meeting, discuss subjects with which air brake inspectors have to deal, methods of inspection, instruction on and maintenance of the air-brake equipment of locomotives and cars.

Local air brake clubs occupy the same position relative to the Air-Brake Association as the several railway clubs do to the Master Mechanics' and Master Car Builders' Associations, taking up and discussing topics of local interest and putting in concrete form ideas and recommendations to the parent associations for their consideration.

New England Air-Brake Club Meeting.

A successful meeting of the New England Air-Brake Club was held in the N. Y., N. H. & H. R. R. Air-Brake Instruction Car at Boston, October 15. There were 17 members present, and the subject of location of main reservoirs was thoroughly discussed. In the afternoon the members had the pleasure of listening to a very interesting paper on "Brake Shoes" read by Mr. F. W. Sargent, chief engineer of the American Brake Shoe Co. It is very gratifying to note the rapid, strong growth of this club.

Mr. S. J. Kidder, one of the oldest representatives of the Westinghouse Air Brake Co., and formerly located in Chicago, has been promoted to a position with the American Brake Co. branch at St. Louis, Mo. Mr. Kidder carries with him our very best wishes for a continuation of his past successful career, so well known to railroad men in the Chicago district.

We are always glad to see the promotion of air-brake men to higher and more responsible positions. Mr. E. H. De Groot, Jr., has been recently appointed superintendent of the St. Louis and St. Elmo divisions of the Chicago and Eastern Illinois Railroad, the appointment becoming effective October 1, 1902.

Mr. V. C. Randolph, formerly engineer on the Erie Railroad and at present a member of the Air Brake Association, has resigned his position to accept an air-brake instructorship on Car 103 of the International Correspondence Schools of Scranton, Pa. He has our very best wishes.

QUESTIONS AND ANSWERS

On Air-Brake Subjects.

(212) W. J. H., Wellington, New Zealand:

Can the equalizing piston, excess pressure spring or triple be cleaned under pressure? If so, how to do it? A.—None of these parts can be cleaned while under pressure.

(213) G. W. K., Cumberland, Md., asks:

What is the object of making the passageway inside of the connection between the brake valve body and the pipe leading to equalizing reservoir so small? A.—This restriction is placed between chamber D and the equalizing reservoir in order that the pressure coming from main reservoir to the train pipe in releasing brakes, may not pass too readily into the equalizing reservoir, but will tarry in chamber D and thereby hold down the equalizing piston to its seat.

(214) H. A. R., Buffalo, N. Y., writes:

We had a double-header with 46 cars of air. Engineer on the head engine handled the air. When he made a 15-pound reduction to try his brakes, he only got an exhaust out of the angle fitting for about 10 cars. He got scared and looked the train over himself and found the 46 brakes applied and released all right. He handled that train for 60 miles and in all that time never got a blow that he should have got for a 46-car train. After setting the pusher out he went on with the head engine and he got a good, strong, perfect blow that he should have got with the 46-car train. Can you explain why he didn't get a long blow when the two engines were coupled to the train? The second engine was properly cut out by means of the cut-out cock in the train pipe under the brake valve. A.—Either the engineer on the second engine helped to apply brakes or else there were probably some bad leaks at the coupling between the two

engines or in the train pipe of the second engine that assisted in reducing train line pressure.

(215) A. P., Newtown, Australia, writes:

Is it possible for a duplex gage to register train pipe pressure, say 60 pounds, when there is actually no pressure in the train pipe? A train was running off a down grade and the driver states that after making first application and with train under control, the gage showed 60 pounds in the train pipe. On approaching terminal a further reduction was made with no effect. On a full application being made it was found there was no air in the train pipe. If this is possible, should not the gage connection be made direct to the train pipe? A.—A gage may be out of order and the hands register pressure not actually carried, but the error will remain the same and not vary much on a single trip. The packing ring in the equalizing piston is not fitted so tight as to allow the train pipe pressure to disappear and still have chamber D pressure registered on the gage. In fact, it is difficult to fit the ring tight enough to prevent train pipe pressure from leaking up into chamber D before the train pipe discharge has ceased at the angle fitting of the brake valve. It would be impractical and unwise to connect the gage to the train pipe direct instead of to chamber D.

(216) W. J. H., Wellington, New Zealand:

With train of seven or eight cars, the driver can make a first-class stop and no jar, but when the train consists of 15 to 20 cars there is more or less jar. Can you give the reason? A.—The jar complained of is doubtless due to excessive slack between the car couplings. On a long train the slack, or lost motion, between the cars increases to an extent which will produce jars or shocks when brakes are first applied and when they are released, if they are not very carefully handled. This is because the head cars near the engine are affected first, both in application and release. The rear brakes being slower to respond in both cases. On American railroads, when this trouble first manifested itself in long trains, a retaining valve was put on the locomotive and it held in the slack and kept the train bunched. This gave considerable relief, but as the length of trains increased, the retaining valve became inadequate. The trouble is now being successfully met on all lengths of trains by the use of the combined straight and automatic air brake as illustrated in our November issue. By the use of this device the straight air brake may be held fully applied to a locomotive and tender while the brakes on the train are being released, thus holding the train "bunched" and preventing the jar caused by the slack running out.

(217) G. W. K., Cumberland, Md., writes:

You would oblige me very much by answering through the columns of Locomotive Engineering the following two questions: 1. An air-brake inspector finds a G-6 brake valve to act in the following manner: If brake is released on engine and handle brought to running position, then moved to lap position just about the time feed valve closes, equalizing piston will rise and brakes apply. If left in running position 10 or 15 seconds then brought to lap, nothing unusual can be noticed in brake apparatus. Not having seen this engine, I advised the engineer to examine the small port in the connection between the brake valve and the equalizing reservoir pipe, and see that it and the pipe was open; but it seems to me, if this pipe was partly closed, so as to momentarily restrict the flow of air between chamber D and equalizing reservoir, it would be very noticeable in a service application by the black hand falling too fast; kindly explain what effect this would have and what else could cause brake to act in this manner. A.—A reasonable solution of the problem would be a partial stoppage of the passageway between chamber D and the equalizing reservoir. This may be due to either a stoppage in the pipe proper or a squeezing together of the gasket in the union in such a way as to reduce the passage opening. This frequently occurs.

(218) M. S. E., Soledad, Mexico, writes:

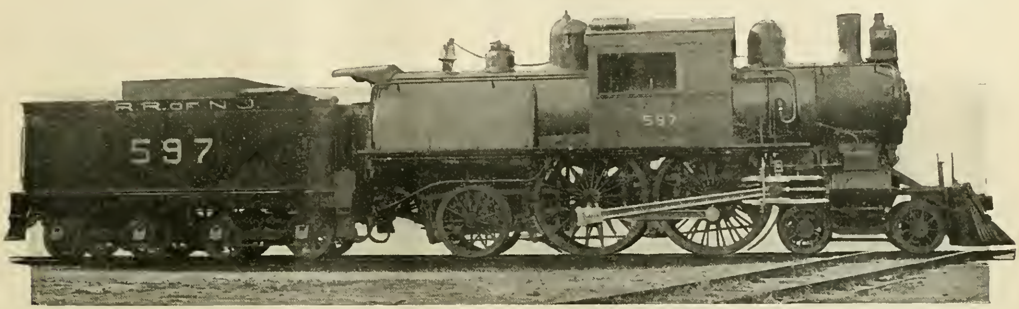
I am a locomotive engineer and ran an engine out of the city of Mexico for 6 years. I have an air brake question that I would like to ask. The train in question consisted of 8 coaches and 1 baggage car. The coaches are on one track and the air is tested on them by the air plank. The engine and baggage car are on another track, and the air was tested on them, and the brake valve worked all right. Just before leaving time the engine and baggage car was coupled to the train and started out. In making the running test, starting out of the yard, the brake valve would not lap, and in making stops it would not lap either. The valve was thrown into emergency two or three times, but that did not help it. During the trip of 120 miles the valve did not lap once. I had to handle the train down a 1 1-2 per cent. grade with the stop-cock underneath the brake valve. When the engine was cut off the train at the end of the run, the valve worked all right again. What would cause this trouble? A.—There was probably a slight leak somewhere in the equalizing reservoir, chamber D, or in the connecting pipe. When the train was short, as in the case of the engine alone, or when it was coupled to the baggage car, there was not volume of air under the equalizing piston sufficient to raise it in response to the leak above from chamber D. But when the volume of train pipe air was increased by coupling on several more cars, the piston would rise and stay up as long as the valve handle was left on lap. This is a common cause of "losing the lap." The valve should be painted with soapsuds on the parts mentioned to detect the leaks.

(219) G. E. C., Moncton, N. B., Canada, writes:

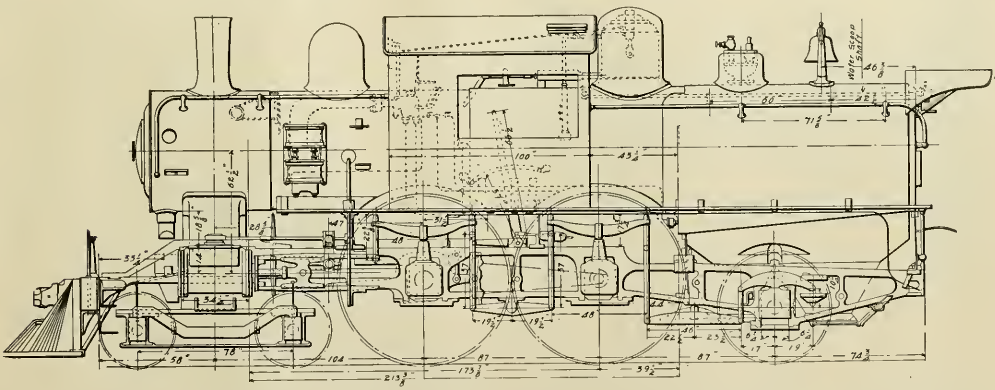
In answer to question 191, in the September issue, you state that a leaky graduating valve will not release a brake without the help of a slide valve leak. Now suppose we take a triple with a perfectly tight slide valve face and seat and charge the train line and auxiliary reservoir to 70 pounds. Let the engineer make a 5-pound reduction of train line pressure and laps his valve. The greater auxiliary pressure will force the triple piston down, first closing the feed groove to the auxiliary and unseating the graduating valve. The auxiliary pressure will pass through port W into port Z in the slide valve face, but it cannot get any farther, as port Z does not register with port F in the slide valve seat and the exhaust port is still uncovered. By the time the triple piston touches the graduating stem (which resists any farther movement), port Z will register with the service port F in the slide valve seat, and a direct communication is established between the auxiliary and brake cylinder. When about 5 pounds of auxiliary pressure has passed to the cylinder, the train line pressure, being still a little greater, will force the triple piston up about 3-8 of an inch or enough to seat the graduating valve. The triple is now in lap position. Now suppose the graduating valve does not seat properly, due to dirt or some other cause, and the valve leaks. The auxiliary pressure will leak out of port W into port Z, then into port F and thence to the brake cylinder. As soon as it has reduced the auxiliary pressure 5 or 10 pounds (and that would not take long if the leak were heavy), the greater train line pressure will force the triple piston and slide valve to release position, and the brake will release. Please state why the slide valve would have to leak to cause the brake to release in this case. A.—Because, as stated several times recently in these columns, the slide valve will have to pass through the lap position, where train pipe and auxiliary pressures are equalized, before it can enter the release position. The slide valve will be unable to pass through lap position, where auxiliary reservoir pressure is blocked off, and cannot reduce further unless there is a leak in the face of the slide valve or the seat. Consequently, the slide valve will stop on lap unless a dirty condition of the triple piston on the slide valve may cause it to "jerk" into release position.

Fast Engines of the Atlantic Type for the Central Railroad of New Jersey.

A very good example of adapting means to an end is to be found in the new Baldwin engines recently bought by the C. R. R. of N. J. for their Atlantic City flyers. These trains are not heavy, but continuous transportation at high speed is what the company sells to that seaside resort. The cylinders are 18 x 26 inches, driving wheels measure 84 1-4 inches outside tires and the weight of the whole machine in working order is 151,000 pounds.



NEW JERSEY CENTRAL—ATLANTIC EXPRESS ENGINES.



ATLANTIC LOCOMOTIVE ELEVATION—CENTRAL RAILROAD OF NEW JERSEY.

The engines are simple, with ordinary balanced slide valves actuated by indirect motion. The extension rod from link block to rocker is a U-shaped cast steel bar which passes over the forward driving axle, and is stiffened across the gap by two bolts, placed one above the other, with pipe filling pieces around them. The rocker box is between the two bars of which the frame front is composed and acts as a very substantial filler. The frame splicing presents interesting features as will be seen in our illustration, and the main frame has all the usual brake hanger brackets replaced by vertical bars forged solid, being in fact parts of the frame itself. The pin hole in the forward one is bushed, as from the position of the driving tire, it is only possible to get the hanger pin in from behind, and the point, carrying the brake hanger, is cross-pinned through, so that motion takes place in the bushed hole. The pedestal binders are cut out 1 3-4 inches for the jaws and in the forward end of the front pedestal binder two bolts are used, one a long collar bolt doing duty in the frame splice and the other with upper nut and key placed in a recess in the frame where metal can be cut out without weakening the bar. The frame is further provided with rubbing pieces which are secured with 1-2-inch studs and are lipped over the sides so that the spring hangers cannot rub or cut into the frame at any point.

The equalizing of weight on the drivers and carrying wheel is continuous, and the details connected with the latter are very ingenious. The carrying wheel axle box has an equalizer on top which gives plenty of clearance and renders the top of the box easy of access, notwithstanding that the frame above it is pierced with an oil hole, and lubrication is effected by means of an oil cup on the frame. The equalizer terminates at the back end in two coil springs, and at the front end it engages by means of a hanger with a steel casting of trough-like section, with the central portion of the bottom taken out. Upon the two remaining pieces of the trough-bottom rest the ends of an ordinary semi-elliptic spring, and the top of its strap forms the fulcrum for this novel equalizer. Very satisfactory adjustment of weight can be had by sliding the spring forward or back as required. The spring strap is fitted with a dowel-pin which goes into one of three shallow holes drilled in the lower bar of the frame, immediately under the solid "piller" which carries the middle brake hanger. The advantages of this design are economy of space, better adjustment and a freer movement of the spring than if its back ends had been connected direct to the frame.

A neat arrangement for oiling the top guide bar may be observed on these engines. There are two oil cups on each top guide. One feeds through a hole directly to the wide bearing of the crosshead in the usual way, the other has a shallow 7-8-inch hole, from which two 5-16-inch holes run at an angle down to the top edge of the recess cut along the guide for the upper lips of the crosshead. The outside upper edge of crosshead and

guide are flush, the guide overhang being 1-2 inch, just sufficient to cover the lip of the crosshead.

These engines are fitted with what is known as the Acme self-adjusting cellar on the engine truck boxes, and the Reflex water gage is used. Automatic spring adjusters keep the brake shoes from tipping forward and wearing away on the top. The firebox is radially stayed, and in addition to the regular ones there are two washout plugs in the bottom of the shell, one in each course.

A passenger agent once claimed for his road Comfort, Celerity and Civility. These three C's may also be found here; comfort on the engine, celerity in the train service and the presence of the last on the road is too well known to require even formal statement. Some of the dimensions are as follows:

BOILER.

Type, Wooten, straight top. Diameter, 58¼ in.
Thickness of sheets, ⅝ in. Pressure, 200 lbs.
Fuel, hard coal.

FIREBOX.

Material, Steel. Length, 109 in. Width, 97 in.
Depth, front 54½ in., back 41½.

TUBES.

233. Dia., 2 in. Length, 16 ft. 6 in. No. 12 B. W. G.

HEATING SURFACE.

Fire box, 170.7 sq. ft. Tubes, 2,002.8 sq. ft.
Total, 2,173.5 sq. ft. Grate area, 73 sq. ft.

CARRYING WHEELS.

Diameter, 54¾ in.

WHEEL BASE.

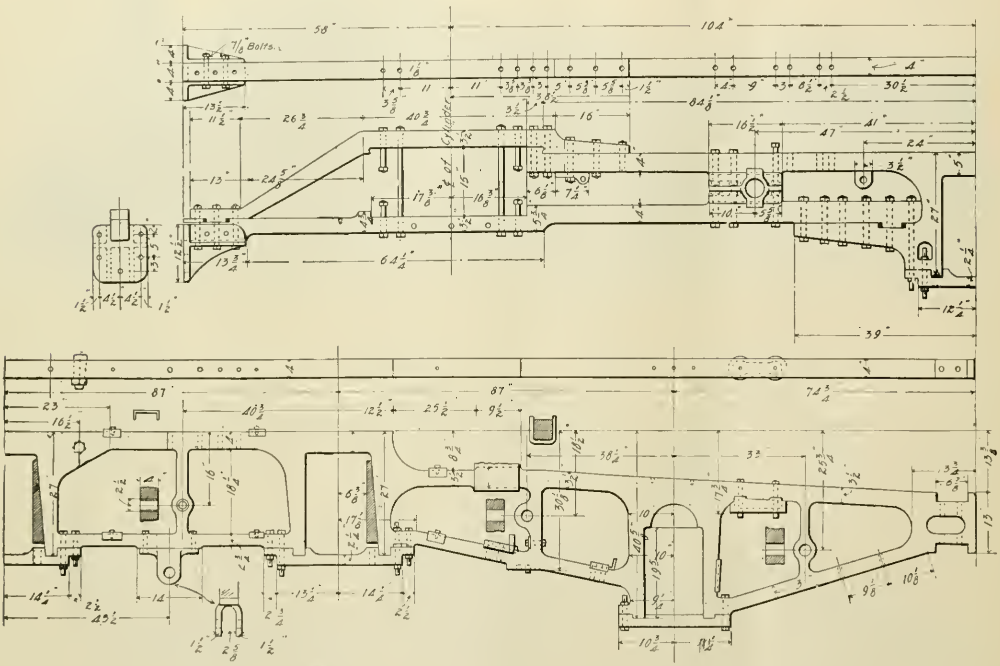
Driving, 7 ft. 3 in. Rigid, 14 ft. 6 in.
Total engine, 26 ft. 5 in.
Total engine and tender, 53 ft. 2 in.

WEIGHT.

On driving wheels, 84,100 lbs.
On truck, front, 32,300 lbs.
On carrying wheels, 34,600 lbs.
Total engine, 151,000 lbs.
Total engine and tender, about 250,000 lbs.

TANK.

Capacity, 5,000 gallons.



DETAIL OF FRAMES FOR ATLANTIC LOCOMOTIVE—CENTRAL OF NEW JERSEY.

The Acme Machinery Company, of Cleveland, Ohio, have issued a very comprehensive illustrated catalogue showing the various machines and appliances made by them. The special adjustment die head as applied to bolt cutters is shown. The Acme dies are illustrated and some remarks on making, recutting and lubricating dies have been introduced. The prices of separate Acme die heads and dies are given. The great variety of bolt cutters made by this company are each shown with cut and appropriate letterpress, also varieties of nut-tapping machinery and machines for pointing bolts and studs. Some useful tables regarding screw threads, speeds for threading bolts and nuts are to be found in this catalogue, while the concluding pages give a description of the company's latest heading, upsetting and forging machines, with halftone showing the variety of forgings which can be made by these machines. Copies of the catalogue may be had upon application to the company.

Mr. Harry A. Norton, who has just returned from an extended trip abroad, says the American industrial invasion of Europe is not a dream as far as the Norton ball-bearing jacks are concerned, as the Boston plant has many new and important European contracts in addition to recent extensive foreign shipments, which show that American-made jacks are successfully meeting competition in foreign markets.

"One thing at a time, and that well done leads to perfection," is a wise saying often heard among the mechanical officials of the Erie.

Two very attractive catalogues have been issued by the Allis-Chalmers Company. Book No. 1 deals with the Gates rock and ore breaker. The half-tones are excellent and the descriptive matter is full and to the point. Book No. 4 describes the general mining machinery made by this concern. Half-tones, engravings and line cuts are profusely used with appropriate letter press concerning each machine shown. These catalogues will be sent to those interested upon application to the company, Gates Works, Chicago, Ill. This species of machinery is especially interesting to the engineering department of railways, since rock crushing for ballast is coming into general use.

Of Personal Interest.

Mr. A. Griggs has been appointed superintendent of the Alabama Great Southern Railroad Company.

Mr. Henry Goldmark, assistant engineer of the Canadian Pacific, is in charge of the erection of the new Hochelaga shops.

Mr. W. S. Galloway has been appointed assistant engineer of tests on the Baltimore & Ohio, with office at Mount Clare, Baltimore, Md.

Mr. J. G. Leefeever has been appointed assistant road foreman of engines on the Mount Clare, has been transferred to Newark, Ohio, to occupy a similar position.

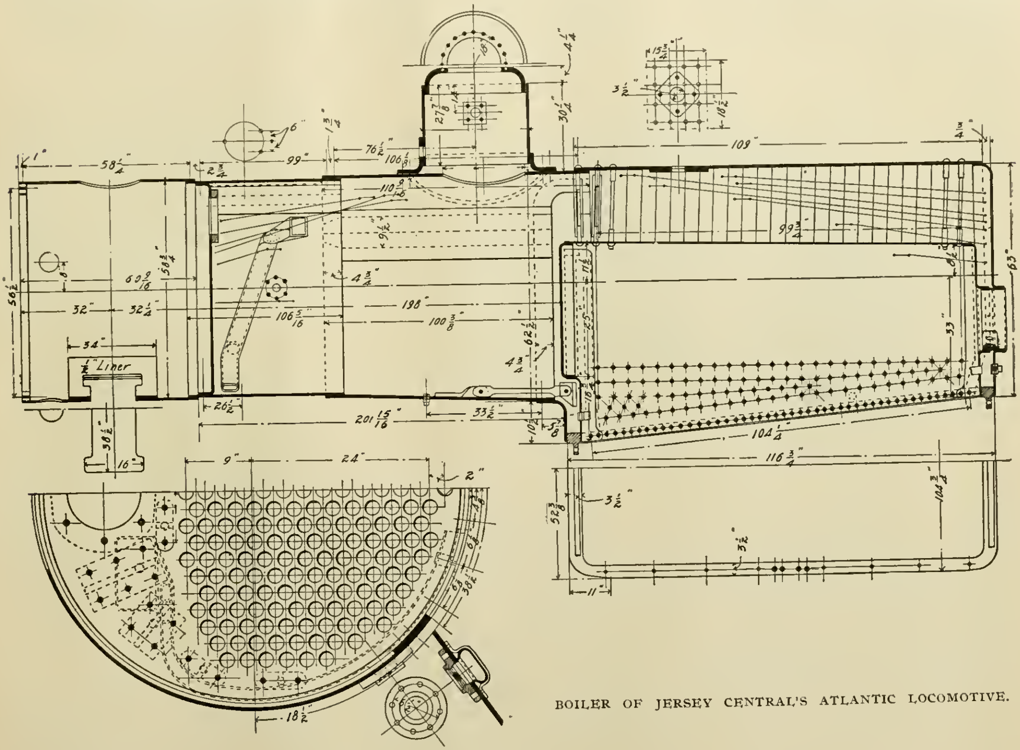
Mr. J. H. Pengelly, formerly master mechanic on the Mexican International at Durango, has resigned in order to accept a position with the Hidalgo Mining Company.

Mr. G. L. Van Doren has been appointed superintendent of the Elizabethtown shops of the Central Railroad of New Jersey, vice Mr. W. L. Harrison, resigned.

quarters at Birmingham, Ala., vice Mr. C. S. Hayden, resigned.

Mr. C. W. Nellis, master mechanic of the Baltimore and Ohio at Newark, O., has been appointed master mechanic of the C., R. I. & P. shops at Chicago, vice Mr. Stocks, resigned.

Mr. J. H. Kelley has been appointed traveling engineer of the Fort Worth & Denver City railway with headquarters at Childress, Texas. He will have jurisdiction over the entire line.



BOILER OF JERSEY CENTRAL'S ATLANTIC LOCOMOTIVE.

Baltimore and Ohio Railroad, vice Mr. E. G. Brown, transferred.

Mr. Wm. B. Norris, general foreman of machine shops at West Philadelphia, has been appointed general foreman at Altoona, vice Mr. J. Davis, promoted.

Mr. Joseph Davis, general foreman of the Altoona machine shops of the Pennsylvania, has been appointed master mechanic on the same road at Harrisburg, Pa.

Mr. E. E. Weisgerber, master mechanic on the Baltimore & Ohio Railroad at

Mr. E. T. James, heretofore master mechanic on the Lehigh Valley Railroad, has been transferred from Wilkes-Barre to Buffalo as master mechanic of the Buffalo division.

Mr. J. F. Sheahan, master mechanic on the Southern Railway, at Selma, Ala., has been transferred to Columbus, S. C. He will hereafter be master mechanic of the Savannah division.

Mr. M. M. Richey has been appointed superintendent of the Birmingham division of the Southern Railway, with head-

Mr. Wm. Jenkins, formerly shop foreman on the Southern Railway at Blacksburg, S. C., recently resigned to accept a similar position with the Mexican Central Railway at Monterey, Mexico.

Mr. Henry Montgomery, formerly general foreman of the Oil City shops of the Pennsylvania, has been appointed master mechanic of that road at Oil City, Pa., vice Mr. D. E. Cassidy, promoted.

Mr. James McDonnough, formerly road foreman of engines on the Gulf, Colorado & Santa Fe, has left that road to

become assistant division superintendent of the Southern Pacific, with office at Houston, Texas.

Mr. H. N. Breneman, master mechanic of the Baltimore & Ohio, at Newark, O., has been appointed assistant superintendent of motive power of the Chicago, Milwaukee & St. Paul, with office at West Milwaukee, Wis.

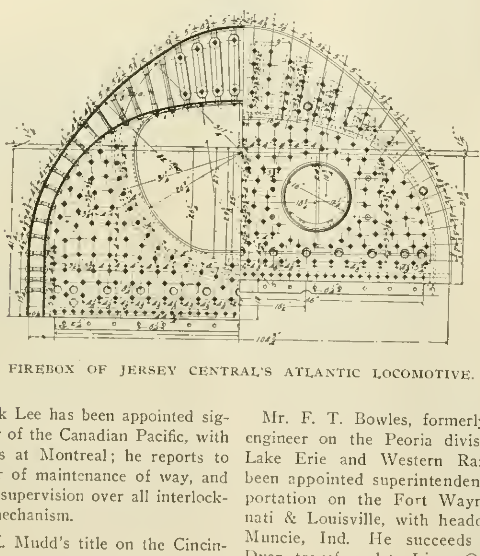
Mr. F. F. Gaines, heretofore mechanical engineer of the Lehigh Valley Railroad, has been appointed master mechanic of the Wyoming division, with headquarters at Wilkes-Barre, Pa., vice Mr. E. T. James, transferred.

Mr. David Patterson, heretofore master mechanic on the Atchison, has been appointed master mechanic on the Denver & Rio Grande, Rio Grande Western, and Colorado Midland, with headquarters at Grand Junction, Col.

Mr. W. L. Harrison has been appointed master mechanic on the Choctaw, Oklahoma & Gulf, with headquarters at Little Rock, Ark., vice Mr. Chas. H. Welsh, resigned. Mr. Harrison was formerly in charge of the shops of the C. R. R. of N. J. at Elizabethtown.

Mr. J. J. Reid recently resigned the position of general foreman on the Rutland Railroad, and has been appointed general machinery and locomotive inspector on the Northern Pacific. He reports direct to Mr. A. E. Mitchell, superintendent of motive power.

Mr. Webb C. Ball has been appointed chief watch inspector of the New York Central, with headquarters at Cleveland, Ohio, vice Mr. Frank Hammond, resigned. This appointment places the principal Vanderbilt lines under one time service and watch inspection system.



FIREBOX OF JERSEY CENTRAL'S ATLANTIC LOCOMOTIVE.

Mr. Frank Lee has been appointed signal engineer of the Canadian Pacific, with headquarters at Montreal; he reports to the engineer of maintenance of way, and has general supervision over all interlocking signal mechanism.

Mr. H. K. Mudd's title on the Cincinnati, Richmond & Muncie is that of master mechanic. He is in charge of locomotive and car departments, with headquarters at Richmond, Ind.; he succeeds Mr. T. E. Merritt, resigned.

Mr. H. E. Passmore has been appointed superintendent of motive power of the Detroit Southern Railroad. He leaves the Western Maryland Railroad to take this position. Mr. Passmore succeeds Mr. E. M. Roberts, who will assume other duties.

Mr. J. H. Moore, formerly master mechanic of the Erie, at Buffalo, has been transferred to Rochester as master mechanic on the same road; he succeeds Mr. W. M. Perrine, who goes to Port Jervis, N. Y., as master mechanic in place of Mr. F. Tuma, transferred.

Mr. F. T. Bowles, formerly traveling engineer on the Peoria division of the Lake Erie and Western Railroad, has been appointed superintendent of transportation on the Fort Wayne, Cincinnati & Louisville, with headquarters at Muncie, Ind. He succeeds Mr. Geo. Dyer, transferred to Lima, Ohio.

Mr. M. W. Maguire has been appointed general superintendent of the Cincinnati, New Orleans and Texas Pacific Railway, with office at Cincinnati, O., the position of acting assistant general manager being discontinued. Division superintendents and the superintendent of car service will report to the general superintendent.

Mr. Charles Parsons, who has been engaged in railroad mechanical work and in the sale of engineering and railroad supplies, has now connected himself with the Chicago Pneumatic Tool Company. Mr. Parsons has been some thirteen years with the railway lines now forming the Erie Railroad, and also for a number of years with the Tiffany Refrigerator Car Company and other concerns.

Mr. W. B. Poland has been appointed superintendent of the Indiana Division of the Baltimore and Ohio Southwestern Railroad, with headquarters at Cincinnati, Ohio, vice Mr. L. C. Fritch relieved on account of illness. Since May 1, last, Mr. Poland has been division engineer on the Pittsburg Division of the Baltimore and Ohio, and previous to this was division engineer on the Baltimore and Ohio Southwestern, Mississippi Division.

Mr. W. H. Marshall, general superintendent of the Lake Shore & Michigan Southern Railway, is going to perform the duties of general manager vacated by the death of P. S. Blodgett. The crowd of friends connected with railroad life who regard Mr. Marshall as a friend will be pleased to learn about this evidence of his efficiency. We know that he is very popular with the higher officials, and there is no doubt that the temporary appointment will soon be made permanent.

Mr. A. R. Greig, chief draughtsman of the Canada Atlantic Railway, was, on the eve of his departure for Winnipeg, presented with a gold watch, chain and locket by a number of employees of the company, consisting principally of his air-brake class. An address accompanied the gift expressing the personal esteem of his fellow employees and their high appreciation of his efforts in the matter of air-brake education. Mr. Greig joins the staff of the Canadian Northern Railway as chief draughtsman.

Mr. W. H. Stocks, who has been master mechanic of the Chicago, Rock Island & Pacific Railroad for several years, has resigned from that company to accept an appointment as representative of the Gold Car Heating and Lighting Company, of New York, Chicago and London. Mr. Stocks has been associated with the mechanical departments of the Minneapolis & St. Louis Railway, Great Northern Railway and Chicago, Rock Island & Pacific Railway for twenty-five years, during which time he has held the position of foreman, general foreman and master mechanic on the roads mentioned.

The Leonard family, famous in England and Wales for their iron foundries during the sixteenth and seventeenth centuries, some of whom came to this country in 1651 and established a foundry in Massachusetts, and two years later started the first foundry near Rahway, N. J., will raise a memorial at Taunton, Mass., where many of the family have since continued in business, which shall have its foundation stones laid on the 250th anniversary of the establishment of the industry in America. The monument will cost between $150,000 and $200,000, and will be placed in the square.

Engineers Wanted.

We have received applications to recommend about one hundred locomotive engineers. They must be good reliable men with clean clearances from the roads where they have worked. The men are wanted for railroads in Kentucky, Tennessee, Kansas, Texas and Oklahoma. There is no trouble expected on any of the roads; merely heavy business. Apply to this office.

Abusing American Locomotives.

The newspapers in Great Britain appear to watch as keenly for evil reports about American machinery as they watch developments of a society scandal or of a political quarrel. They are always delighted to find any excuse for writing disparagingly of machine tools, agricultural machinery and other American articles in favor among European users, but what pleases them most is to hear unfavorable reports of American-built locomotives.

A report lately reached London from the manager of the Assam Railway Company, in which he says that four American locomotives which were secured less than four years ago, require new crown plates. He adds that the makers of the locomotives ought to pay the cost of repairs, as failure after such a short space of time could only be due to carelessness in design.

We never heard of any railway official condemning himself out of his own mouth so ridiculously as what is done by the statement of the Assam Railway Company's manager. Crown sheets, as we call them, of fire boxes, very rarely fail without the men in charge of the engines being to blame. It is of the very greatest importance that the crown sheet should always be covered with water. Low water is one of the principal causes for crown sheets failing. The crown sheet ought to be kept free from mud deposits and from scale. Accumulations of mud lead to the failure of more crown sheets than all other causes combined, and this source of destruction arises from gross carelessness in washing out the boiler.

The report of the manager of the Assam Railway ought to have read: "We have four American locomotives that require new crown plates after four years' of service. I have no idea what has been the cause of the premature failure of these plates. The enginemen are in the habit of permitting the water in the boiler to fall so low occasionally that the bare crown plates are exposed to the action of a hot fire, and they do not seem to endure the heat well at such times, for the plates warp and the seams leak. There is considerable mud in the feed water which gradually settles upon the flat crown plates until they have a thick covering of this non-conducting material. This has an evil effect upon the crown plates, yet the makers of the locomotives have never sent an expert to remove that blanket of mud. I respectfully suggest, to my directors, that in the next lot of locomotives ordered they specify that the crown plates be made proof against any unusual heating due to scarcity of water and to too great abundance of mud."

Of course editors of British newspapers cannot be expected to know anything about what causes crown sheets to fail, and most of them do not wish to obtain the information. What suits them is any excuse for abusing American locomotives.

The urgent demand for new locomotives has moved the Baldwin Locomotive Works to make permanent extensions of their plant. A new line of extension has been adopted which is to concentrate as much as possible of the heavy work at Lewistown, where the Standard Steel Works are located. These works belong to the Baldwin people and are fully equipped for the manufacture of steel tires and can also turn out car and locomotive wheels, steel forgings and castings and a great many parts used in locomotive construction.

For the first time since the original purchase of equipment the Canadian Pacific is going to import locomotives from the other side of the Atlantic. All of the American Locomotive Company's plants, along with the independent firms, including the Rogers and Baldwin works, are pushed to the wall with orders for the coming year. The consequential inability of the Canadian Pacific to procure delivery when required has caused it to place an order in Scotland for 12 10-wheel locomotives.

There was once a superintendent of the Staten Island Railroad who was a spelling reformer, and favored the phonetic method. He had some crossing signs put up which read: "Luk out for the Bulgine wen the bel rings or wisles." This method of advertising the reform was short-lived, and ended when a native stood on the track studying the meaning of the words until he was struck by an engine.

The Illinois Central has issued a peremptory order that the practice of carrying concealed weapons by employees while at work must be stopped at once.

The influence of fashion on specification of railway equipment was strikingly illustrated lately when a master mechanic wanted a wide firebox extending over the frames for a 17 x 24-inch passenger engine. Were it not for the desire to be in the fashion, a good many expensive attachments to railroad rolling stock would be left off.

Would Rather be a Fireman Than a College Student.

John Gregg, 14 years old, of Principio, Md., is a quick-witted boy. In rambling near his humble home he found a portion of the track of the Pennsylvania Railroad washed out by a rain storm, and the Colonial Express approaching. John pulled off his coat and ran toward the approaching train swinging the small garment as a danger signal. The engineer saw the boy in time, stopped the train and prevented a bad wreck. The Pennsylvania Railroad is a corporation with several souls inside and they offered to give John a college education. John thinks that he would rather be a fireman, but he is given a year to consider the matter. If he accepts the college course in the end he would naturally finish at Altoona with many rosy possibilities facing his career.

Prizes for Essays on Railroads.

The Pacific Coast Railway Club seem to be exceptionally enterprising, for they are offering $250 in prizes for essays pertaining to the construction, equipping, maintaining and management of steam railways, the papers to contain not less than 2,000 and not more than 6,000 words. The papers must be in the hands of the secretary, Mr. C. C. Borton, 1213 Twelfth street, Oakland, Cal., by January 1. We expect that some of the prizes will go to contributors of the Railway and Locomotive Engineering, and trust that our best writers will enter the competition. Every one who writes an essay on the subject specified will derive much benefit from his work, whether or not he secures a prize. The best practice for learning facts on any subject is to write all you know about it. It frequently proves how defective one's information is.

A curious question came under discussion at the last meeting of the Transcontinental Passenger Association. They were called upon to decide the status of Buddhist missionaries who apply for reduced rates on the ground that they are ministers of religion. The case is under prayerful consideration, the Christian ministers being strongly in opposition.

The Baldwin Locomotive Works will ship in a few days a consignment of ten locomotives to Guatemala for use on the new railway system to be built there by American capitalists, connecting the Atlantic and Pacific Oceans. It is said that the new road will bring San Francisco 1,500 miles nearer to New York than the Isthmian Canal route. Two hundred cars will be used on the road, and they will be purchased in this country. Several hundred trucks and 6,000 tons of fifty-six-pound rails will also be purchased in the United States.—*Phila. Ledger.*

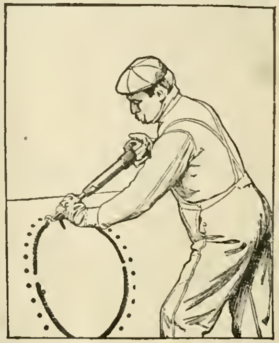
The C. W. Hunt Company, of New Brighton, New York, recently received word that at the Dusseldorf Exhibition, which has just terminated, the gold medal representing the highest award of merit had been given to the Hunt conveyor. The company's works are on Staten Island. People in want of good conveyors for coaling stations or other purposes ought to send for C. W. Hunt Company's catalogue.

The Structural Steel Car Works, of Canton, Ohio, got into financial trouble before the car building began, and the works have been standing in an unfinished condition. We now understand that the company has been capitalized by an eastern syndicate, and that the works will soon be started out with a full working force. When properly running it is said that they will have the greatest capacity for car building of any shop in the country.

The New York, New Haven and Hartford R. R. people have placed an order for several compound locomotives to be used as switchers in the Providence yards. A change of policy must have taken place in the mechanical department of that road for in the past they have shown less than favor to compound locomotives. They had a remarkably good compound locomotive designed by F. W. Dean, the well-known mechanical engineer of Boston, but the engine never received fair play, and always worked under the disadvantage that the men understood the management to be against it.

The Delaware, Lackawanna and Western R. R. Co. have fitted up a locomotive for the purpose of permitting the students of Cornell University to make engineering tests. The tests will be carried on in the usual fashion, indicator diagrams will be taken, the amount of coal and water used will be ascertained, and some approximation will be made of the work done by the engine. From these data calculations will be made of the efficiency of the engine. It is very good practice for the student, but is of very little value to the railroad company. The Lackawanna Co. deserves credit for fitting out the engine and defraying the expenses of the tests.

It is reported that the Whitney Car Wheel Company are looking for a new location. We note a lament from a Woodbury, N. Y., paper because its citizens could not raise $25,000 as a bonus to induce the wheel makers to locate in that town. We always think that a manufacturing concern is falling into littleness when it peddles its location to the highest bidder.



Switch Point Protector.

A device has recently been perfected which promises to be a great labor saver and a safety appliance as well. It consists of a metal covering for switch points which will effectually prevent the accumulation of snow between switch points, which oftimes results in accident. With this device in operation accident to persons or stock will be effectually obviated, as the openings are securely guarded and covered. It operates automatically with the throw of the switch, and requires no material power to operate the switch; is cheap in construction, and will last a lifetime. It cannot cause the switch to become inoperative, or, if out of order, result in derailment or accident. The idea and construction of the device originated with an ex-brakeman, who had lost an arm and was placed in charge of switches and experienced trouble in keeping the switches clear of snow, and operative.

A company has been formed for the manufacture and sale of the device. The Chicago and Northwestern Railway Company has ordered some of these protectors put in and given a thorough test at their division point in Boone, Iowa. The secretary and treasurer of the company is B. H. Smith, of Boone, Iowa, to whom any inquiries may be addressed.

The Pressed Steel Car Co. during October built 3,000 cars. This makes an average for the 27 working days, of 111 cars, and breaks all previous records for output, the daily average for the past four months having been 107 cars. So far this year the company has turned out 22,402 cars. There was consumed in the erection of these cars 350,000 tons of steel. The cars were mostly for the Pennsylvania Railroad, and are part of the 15,000 cars ordered several months ago.

The Philadelphia Pneumatic Tool Co. states that its anticipations in regard to the volume of business for the month of September were fully realized, the sales for that month having amounted to 20 per cent. more than any previous month. Later the monthly record for foreign shipments has been broken, large orders having been received from Great Britain, Germany, France, Italy and Denmark.

The Dixon Company say that it is possible to have tight steam pipe joints if Dixon's Graphite Pipe-Joint Compound is used. Flake graphite is impervious to the action of heat or cold, acids, or alkalies. Hence the value of a graphite compound when properly prepared. The Joseph Dixon Crucible Company, of Jersey City, N. J., will send booklet and sample free of charge.

The first order of passenger cars to be used on the New York underground railroad has been given to a St. Louis firm. The cars are to be made fireproof by being lined with asbestos. It was intended to subject the wood on the cars to a process which would make them fireproof, but the delay would have been too great, and so they are going to be made fireproof by the use of asbestos.

The Pressed Steel Car Co., of Pittsburg, have got their manufacturing processes so well organized that they have lately been turning out 110 cars per day. This calls for the use of an enormous quantity of steel and iron, and has added very considerably to the demand for steel. Within the year the company has turned out 22,402 cars which, if made up into trains of 50 cars each, would make 448 trains, each of them about 1,800 feet long. If the cars were set in line on one track they would extend 175 miles.

Great Western Patent Double Thumb Gloves, manufactured by the Ellsworth & Thayer Manufacturing Company, of Milwaukee, Wis., were exhibited to the delegates at the Firemen's convention at Chattanooga, Tenn., by Mr. Ed. C. Derkin. These gloves are made of special tan Cordavan horsehide and are warranted steam and fire proof. The exhibit was very popular. A neat watch charm of aluminum, representing the Great Western Glove, was given away by this concern.

Baldwin Record of Recent Construction No. 37.

Oil burning locomotives is the subject treated in this issue of the series which the Baldwin Locomotive Works issues as their Record of Recent Construction. Two Russian engines are shown, three for use on railways in the United States and one for an industrial railway. Facts and figures concerning the use of oil as fuel are given, and the economies effected are pointed out.

The neighborhood of Pittsburg is suffering more from a freight blockade than the lines centering in that city have ever endured before. It is said that there are over 60,000 men idle on account of the impossibility of moving cars so that the factories may obtain the necessary raw material.

We understand that Barber Trucks will be used under the nine locomotive tenders being built by the American Locomotive Co., for the D. M. & N. Ry.; also under ten locomotive tenders which the Baldwin Locomotive Works are building for the Erie Ry.

New Plant of the Lunkenheimer Company.

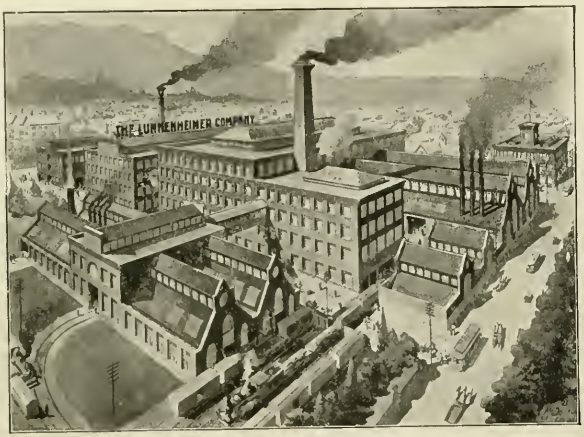
The Lunkenheimer Company, of Cincinnati, Ohio, manufacturers of brass and iron goods and specialties for engines, boilers, etc., on October 25 opened their works to about 3,000 visitors and friends.

The buildings, of which there are five, represent an investment of over $300,000. They consist of the main building occupied by the brass department, with adjoining buildings for the iron department, brass foundry, power building and office building; all are of pressed brick and steel construction of modern type. They occupy about three acres of ground. Three additional acres provide for future extension. These factories are located near Brighton station, in a section of the city called Fairmount. It has been the aim of the company to construct a model plant, and many new and interesting features have been introduced.

The main building, 130x180 feet, is of the gallery type of construction, with a center area measuring 30x80 feet; it is three stories high, and built so that three more stories can be added without interfering with the output of the plant.

A novel feature in the main building is the heating system. Hot air travels through the fourteen large hollow columns, which support the floors around the area in the center of the building. These columns have openings on each floor to distribute the air; the bases of the columns are connected with a huge fan, by means of tunnels, under the basement floor. The type of window used is a novel one, and has a blind arrangement that is of great advantage during summer weather.

The foundry is equipped with modern appliances, such as overhead track system for carrying material, smelting furnaces burning crude oil, and many pneumatic appliances. The general distribution of power throughout the buildings is of the latest type. The source of energy is a 300 h.p. compound engine, which drives a 240 k.w. three-phase, 220-volt, General Electric alternating-current dynamo. Current is led to different parts of the buildings, where suitable motors, principally attached to the ceiling, drive the various lines of shafting. These motors are of the Westinghouse and General Electric induction type, without commutators or brushes. The power from the motors to the shafts is transmitted through what is known as the Renold Silent Chain Gear, which permits of a very compact arrangement, without noise or friction.



LUNKENHEIMER COMPANY'S PLANT.

The engine room is also provided with a large cross compound two-stage Laidlaw-Dunn-Gordon air compressor, which supplies compressed air throughout shops and foundry for driving pneumatic tools, hoists, etc. The boilers are of Babcock & Wilcox pattern, with automatic stokers. The engine room, the floor of which is laid in mosaic tiling, is considered one of the handsomest in the country.

The illumination is furnished by what is known as the Nernst Lamp, and articles exhibited under it have their true color value. Owing to the arrangement of the lamps, the distribution of the light is even and without shadows. Sufficient illumination is secured without providing each operator with an individual light.

The office building is a three-story brick structure, 50x80 feet, with modern

equipment, the second floor being occupied by the drawing and engineering departments, the third by the advertising department, as well as containing a laboratory and photograph gallery. The business was founded in 1862 by the late Frederick Lunkenheimer, and has grown to large proportions, now employing over 700 men. With increased facilities the company expect to extend their line and take up many new engineering specialties. The company's trade is domestic and foreign. They have a branch in London and an office in New York city.

The Allis-Chalmers Company, of Chicago, have issued a catalogue dealing with sawmill machinery. The Edward P. Allis works at Milwaukee, Wis., is where this machinery is manufactured and there does not seem to be anything in this line which they cannot supply. The latest and most approved equipment is represented in the catalogue. The booklet will be sent to any one sufficiently interested to apply to the company for it.

A Pittsburg man has invented a combination box and gondola steel car. The car differs from the ordinary box in that the upper halves of its sides are on hinges and can be automatically opened. A portion of the top of the car also opens, which will permit the free loading of coke and coal. It combines the advantages of a steel gondola and a closed car. There are also lateral doors which can be used for loading and unloading.

The H. K. Porter Company, Pittsburg, have secured a contract for some locomotives for a railway in Japan.

George Daugherty, who died recently at his home in New Florence, Pa., was an employee of the Pennsylvania Railroad Company when Andrew Carnegie was superintendent of the Pittsburg division. Upon the day of his funeral a letter from Mr. Carnegie was received inclosing a check for $20 and the announcement that on the first of each month thereafter so long as he lived he would receive a similar amount. After the funeral the check was returned to the donor with the news of Mr. Daugherty's death. In a few days afterward there came another letter from Mr. Carnegie inclosing checks for $10 each, made out in favor of the dead man's daughters, with the statement that so long as they remained single each one would receive $10 on the first of each month. We are not surprised at this manifestation of Mr. Carnegie's generosity, what surprises us is how he remembers with such minuteness the humble acquaintances of Auld Lang Syne.

The Chicago Pneumatic Tool Co. have just issued a pneumatic hoist catalogue, which deals with various kinds of shop hoists. These pneumatic appliances are not made with the suspended cylinder, the length of whose stroke is the maximum lift. They are practically differential pulley blocks supplied with a compact air motor, which winds up a steel cable or chain, and so lifts the load. These hoists are constructed to handle weights ranging from 1 1-2 to 10 tons at speeds varying from 16 to 4 feet per minute. The hoist is adapted for serving machine tools, and can hold a load suspended indefinitely. Full descriptions of the various kinds and sizes made are given, together with data derived from actual tests. Geared hoists and trolley combined are also made by this company. The Chicago Pneumatic Tool Co., of Chicago, Ill., will be pleased to forward copies of this catalogue upon application.

The Railway Materials Company, Old Colony Building, Chicago, have just issued a little pamphlet in which are set forth the various uses of the Ferguson Portable Heater and Kindler. There are a number of half-tones to show how the device is used. The machine can be taken anywhere about an engine house or yard by one man as it practically consists of a tank mounted on wheels. This tank holds 20 gallons of crude oil and 35 ft. of air hose is attached to it, one end of which is connected to the compressed air system. This heater has been used for straightening bent engine frames, for shimming or removing locomotive tires, for steel car repairs, and for kindling fires in engines. The Ferguson oil furnace for flue welding, forging, bulldozer work, heating bolts and rivets, spring tempering, annealing, boiler work, etc.; is also included in the catalogue. A copy of this pamphlet will be sent to those interested, on application to the company.

Two cars recently built at Pittsburg have the weight, when empty, of about 40,000 pounds. They carry a load of 200,000 pounds, and are the heaviest cars that ever were built. They will be used transporting steel, iron and ores between the different metallurgical establishments in Pittsburg. It is expected that the enormous load they carry will considerably decrease the cost of moving the heavy freight, besides putting the load in compact shape, as one car will carry four times or more what any ordinary car would.

The Canadian Pacific Railway Co. prefer American-built locomotives, but they are so badly in need of early delivery that they have ordered twenty freight engines from a firm in Glasgow, Scotland.

Railroad Mileage and Rolling Stock.

According to the latest edition of *Poor's Manual*, there are 198,787 miles of railroads in operation in the United States. Of this 4,453 miles were built during the past year. The companies own 39,729 locomotives, 27,144 passenger cars, 8,677 mail and express cars and 1,409,472 freight cars. Ten years ago the railroads had 21,889 engines, 14,934 passenger cars and 730,435 freight cars. There has been a decided increase of motive power equipment in the last ten years, and the number of engines added to the total of ten years ago does not make the case clear. It is safe to say that all the locomotives built in the last ten years are 30 per cent. more powerful than those built in the preceding decade.

Tests Were Not Made.

It is curious the way that rumors originate about happenings that never took place. We have been noticing in different newspapers detailed particulars of a thorough trial lasting several months that was made between the Baldwin Atlantic type and the Brooks Atlantic type locomotive in use on the Buffalo, Rochester and Pittsburg Railroad. It is asserted that this was done purposely to test the relative value of piston valves and ordinary slide valves.

When we learned about what seemed to be a very important test, we tried to obtain some particulars from Mr. Turner, the superintendent of motive power, and we have been assured by him that no such tests ever took place.

A Watch Inspection Grievance.

An annoying form of petty tyranny is creeping into many railroads in the form of regulations concerning the watches that train men are permitted to use. A few favored makes are specified and other watches, as good or better, are rejected by the watch inspectors. A correspondent on the Southern Railroad makes a bitter complaint about the new regulations concerning the kind of watches to be used and says that there is widespread dissatisfaction among the trainmen on account of these regulations. There is a decided impression that the make of watches selected are chosen at the instigation of interested inspectors. We believe the complaints to be well founded and we feel sure that proper representation to the management would lead to a remedy.

New Canadian Locomotive Works.

A great many rumors have been current for the last few months that new locomotive works are about to be built in Montreal. There seems to be considerable conflict of opinion about what interests are to control the new works. Some parties assert that they are going to be an addition to the Kingston works, when in operation, while others say that the American Locomotive Co. is backing the enterprise.

There is no doubt whatever that something is going on in the organization of a new or extended locomotive building company, but those most intimately connected with it do not think it desirable to make public the scheme that they are contemplating.

Christmas Presents.

From the number of inquiries which we receive at this season of the year about what mechanical books are most suitable for Christmas presents, we infer that there is a desire among railroad men and women for information on this subject, so we present a few pointers.

A year's subscription to Railway and Locomotive Engineering costs only $2.00, and the paper is a welcome visitor, especially where there are children.

"The World's Railway" is a most interesting history of railways and locomotives. It is beautifully illustrated and the net price used to be $10.00. We now give it and a year's subscription to Railway and Locomotive Engineering for $5.00.

"Locomotive Engine Running and Management," by Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." Price, $2.00.

"Practical Shop Talks." Colvin. A very useful book combining instruction and amusement. It is a particularly useful book to be in the hands of a young mechanic. Has a stimulating effect in inducing young men to study their business. Price, 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains a wonderful amount of information about the locomotive in small compass. Convenient pocket size. We cordially recommend this book. 75 cents.

"Compound Locomotives." Colvin. A little study of this book will instruct a man so that he will understand the construction and operation of a compound locomotive as well as he understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size bound in leather, $1.00.

"Standard Examination Questions and Answers on the Air Brake." Formulated and adopted by the Air-Brake Association, being a book of nearly 700 authors. Brought right up to date. All about air brakes, both Westinghouse and New

York, their construction, operation, disorders, symptoms and cures. Most complete book on air brakes yet printed. Will pass you through anybody's air-brake examination. 135 pages, 6 x 9 inches, containing nearly 1,000 questions with their answers and nearly 100 illustrations. Postage prepaid. 25 cents.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable one to take out license to run stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list. Question and answer style. 128 pages. Pocket size. 50 cents.

"Care and Management of Locomotive Boilers." Raps. A book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil-burning locomotives. 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language easily understood. $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. 25 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for people trying to learn all about air brakes. Tells the whole story. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lessons which appeared in this paper several years ago. They are interesting, laughable and best of all are of practical value. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehension treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

The Rand Drill Company, of 128 Broadway, New York, have just issued an illustrated catalogue devoted to the consideration of their Imperial Air Compressors. These compressors are made

with duplex cylinders, also with compound air cylinders, and with compound steam cylinders. General half-tone views with full description and sizes are given in the 31 pages of this standard publication. The cuts are excellently finished and the get-up of the catalogue is attractive. The Rand Drill Company will be happy to supply those who are interested enough to apply.

Armstrong Brothers Tool Company, of Chicago, familiarly called the "Tool Holder People," have issued a convenient leather covered pocket-book, the center of which is occupied by a neatly printed catalogue which gives information about the various tool-holding devices which are made by this firm. The straight lathe tool holder is made in eleven sizes, the boring tool in six sizes, straight cutoff and planer, each seven sizes, threading tool five sizes and offset cutoff tool eight sizes, right and left offset lathe tools, each eleven sizes. The well-known Armstrong gang planer tool is made in three sizes. This pocket-book has two flat pouches on the inside of the cover for holding cards, memoranda, etc. The idea seems to be that the Armstrong pocket-book will carry your loose papers, and you can carry the Armstrong Bros.' name in your mind when looking for tool holders. The firm will supply the pocket-books upon application.

The Columbus Pneumatic Tool Company, of Columbus, Ohio, have issued an illustrated catalogue showing the uses to which a U. & W. piston air drill may be put. Half-tone cuts show it at work on difficult jobs and in tight places. The letter press consists of pertinent questions and concise explanations and the views given are excellent. This catalogue, which gives a good idea of what the tool will do, will be sent to any one who is sufficiently interested to apply to the company for it.

INDEX TO ADVERTISEMENTS.